ACTUARIAL REVIEW REPORT FOR
MISSOURI STATE EMPLOYEES’ RETIREMENT SYSTEM
AS OF JUNE 30, 2012

www.CavMacConsulting.com
March 11, 2013

Mr. Gary Findlay  
Executive Director  
Missouri State Employees’ Retirement System  
907 Wildwood Drive  
Jefferson City, MO 65109

Dear Mr. Findlay:

Cavanaugh Macdonald Consulting, LLC has performed an independent review of the June 30, 2012 actuarial valuation of the Missouri State Employees’ Retirement System. As an independent reviewing or auditing actuary, we have been asked to express an opinion regarding the reasonableness and accuracy of the actuarial assumptions, actuarial cost methods, and valuation results.

Our analysis of the actuarial assumptions and methods was based largely on the most recent experience study (July 1, 2007 to June 30, 2011) prepared for the System in 2012. Our opinion on the valuation results was based on a replication valuation for the Missouri State Employees Plans (MSEP, MSEP 2000, and MSEP 2011) and a general review of the Judges Plan. The retained actuary for MOSERS is Gabriel, Roeder, Smith & Company (GRS). We would like to thank GRS for their cooperation and assistance in providing the required information to us. We generally find the actuarial valuation results to be reasonable and accurate. The valuation was performed by qualified actuaries and was performed in accordance with the principles and practices prescribed by the Actuarial Standards Board. This report documents the detailed results of our review.

If you need anything else, please do not hesitate to give me a call. The undersigned are members of the American Academy of Actuaries and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained in this report.

Sincerely,

Patrice A. Beckham, FSA, FCA, MAAA, EA  
Principal and Consulting Actuary

Brent Banister, FSA, FCA, MAAA, EA  
Chief Pension Actuary
# Table of Contents

1. Executive Summary ........................................................................................................ 1

2. Review of Membership Data .......................................................................................... 8

3. Actuarial Assumptions .................................................................................................... 9
   - Background on Actuarial Assumptions .................................................................... 9
   - Economic Assumptions ......................................................................................... 10
   - Demographic Assumptions .................................................................................. 16

4. Actuarial Methods ......................................................................................................... 27
   - Actuarial Cost Method ............................................................................................ 27
   - Asset Valuation Method ......................................................................................... 28

5. Actuarial Valuation Results Review ............................................................................. 33
   - Reasonableness of the Actuarial Valuation Results ................................................ 33
   - Content of the Actuarial Reports ............................................................................ 36
   - Compliance with GASB ......................................................................................... 40

6. Qualified Actuaries ....................................................................................................... 41

7. Review of Actuarial Fees .............................................................................................. 42
1. EXECUTIVE SUMMARY

The Missouri State Employees’ Retirement System (MOSERS) issued a Request For Proposal (RFP) for Review of the Retained Actuarial Firm with the following stated objective:

“The Missouri State Employees’ Retirement System (MOSERS), Jefferson City, Missouri is seeking an independent actuary or actuarial firm to provide services sufficient to allow the contractor to express an opinion regarding the reasonableness and/or accuracy of valuation results, actuarial assumptions, and application of the actuarial cost method in connection with the June 30, 2012 actuarial valuation. The contractor must perform a full replication actuarial valuation based on information provided to the retained actuary for the June 30, 2012 actuarial valuation of the system and the assumptions used in connection with that valuation.”

Cavanaugh Macdonald Consulting, LLC (CMC) was selected to provide the requested actuarial auditing services. Our review of the current set of actuarial assumptions and methods was based largely on the most recent experience study (July 1, 2007 to June 30, 2011) prepared for the System in 2012. In performing the replication of the actuarial valuation, several well defined steps were followed. These steps involved a high level review of the data used in the actuarial valuation and a comparison of the valuation data with the raw data from MOSERS, a review of the plan provisions to be valued, an analysis of the actuarial assumptions and methods used in the valuation, a review of the calculation of the actuarial value of plan assets as of the valuation date, and preparation of the actuarial calculations using appropriate computer programming and summarization of the results.

In conducting our replication work, we initially performed the above steps independently from the work of the retained actuary, Gabriel Roeder Smith (GRS). After completing the work, we conducted a review of some individual test lives in order to identify any key differences in programming or technique. We then prepared a summary of the key valuation results, showing a comparison of our results to those of the retained actuary (see Section 5 of this report).

In reviewing this report, it is important to understand that the actuarial valuation process, while very sophisticated in its calculations and methodology, is still an estimate of the financial value of benefits payable on contingent events, most of which occur many years into the future. As such, a considerable amount of uncertainty and variability surrounds those estimates. As actuaries we recognize this fact and, as a result, are comfortable that small differences, in percentages, in the results do not change the overall financial results provided in the valuation. Furthermore, the actuarial software used by different actuarial firms has implicit variations that create differences in the valuation numbers. As a result, we believe it is more appropriate to compare the valuation results in terms of percentage differences than dollar differences. In a replication audit, which was performed for MOSERS, any differences that are identified can be
1. EXECUTIVE SUMMARY

quantified. In this situation, we generally expect to be within 1-2% on the calculation of the present value of future benefits and within 4-5% on the calculation of the actuarial accrued liability and normal cost. The wider range on these latter items is because there tends to be more variability in how different valuation software programs allocate the total liability (present value of future benefits) to past and future years of service. As shown below, the results of the replication valuation for MOSERS were very close with key valuation results within 1% of those prepared by GRS.

<table>
<thead>
<tr>
<th></th>
<th>(A) CavMac</th>
<th>(B) GRS</th>
<th>(A)/(B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present value of future benefits</td>
<td>$11,771,952,161</td>
<td>$11,772,395,758</td>
<td>100.0%</td>
</tr>
<tr>
<td>Actuarial accrued liability</td>
<td>$10,789,595,974</td>
<td>$10,793,651,577</td>
<td>100.0</td>
</tr>
<tr>
<td>Actuarial assets</td>
<td>$ 7,897,167,203</td>
<td>$ 7,897,167,203</td>
<td>100.0</td>
</tr>
<tr>
<td>Contribution Rate:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal cost rate</td>
<td>8.13%</td>
<td>8.04%</td>
<td>101.1</td>
</tr>
<tr>
<td>UAL payment</td>
<td>9.59%</td>
<td>9.60%</td>
<td>99.9</td>
</tr>
<tr>
<td>Member contribution rate</td>
<td>(0.66%)</td>
<td>(0.66%)</td>
<td>100.0</td>
</tr>
<tr>
<td>Employer contribution rate</td>
<td>17.06%</td>
<td>16.98%</td>
<td>100.5</td>
</tr>
</tbody>
</table>

The specific requirements for the review included a review of GRS’ work to the extent necessary to express an opinion related to the following:

- The appropriateness of the demographic and financial information used in the valuation of MOSERS,
- Whether actuarial assumptions are reasonable and consistent with generally accepted actuarial standards and practices; reasonable based on MOSERS’ experience; and appropriate for MOSERS’ structure and funding objectives,
- Whether the retained actuary’s valuation methods and procedures are reasonable and consistent with generally accepted actuarial standards and practices; are appropriate for MOSERS’ structure and funding objectives/are in compliance with Governmental Accounting Standards Board (GASB) reporting and disclosure requirements,
- Whether the retained actuary’s valuation results reflect the requirements set forth in state laws that govern the retirement programs,
- Whether or not the retained actuary’s valuation results are reasonable, including analysis of contribution rates and accrued liabilities,
- Whether the valuations were performed by qualified actuaries and were performed in accordance with principles and practices prescribed by the Actuarial Standards Board, and
1. EXECUTIVE SUMMARY

- Whether the fees paid by MOSERS to the retained actuary are reasonable and proper based on the level of services received.

In summary, the purpose of the actuarial audit was to provide assurance to the Board of Trustees that the valuations were conducted using complete and valid information, that the actuarial assumptions and methods were reasonable and consistent with generally accepted actuarial standards and procedures, that the calculations were accurate, and that the actuarial report fully and fairly discloses the actuarial position of the retirement system. As such, we approached this assignment with a constructive mindset, trying to identify any possible suggestions that might improve the understanding of, or the confidence in, the actuarial services being provided. As a result, it is possible that some of our comments may be viewed as personal preference or “nit-picky” in nature. While we do not intend to impose our own preferences on the retained actuary, we did not hesitate to make such comments if we believed that some change, however minor, would improve the actuarial process or reporting.

Several suggestions and recommendations are made throughout this document that we believe will improve the quality and understanding of the actuarial work performed for MOSERS. The recommendations can be classified as either:

(a) Presentation suggestions to enhance the actuarial report or valuation process;

(b) Follow up item to be considered in the next experience study;

(c) Something that might affect the cost of the system.

(d) Needs attention now.

Where we have made comments or recommendations in this report, we generally bold the recommendation and identify the type of comment in the margin with the following icons:

💡 Enhancement to valuation process or report

📅 Examine during next experience review

💰 May affect the cost of the plan
1. EXECUTIVE SUMMARY

Formal Conclusions

As independent reviewing actuary, Cavanaugh Macdonald Consulting, LLC (CMC) has been asked to provide an opinion on and recommendations for the improvement of the actuarial valuation performed by the Missouri State Employees’ Retirement System (MOSERS) retained actuarial firm, Gabriel, Roeder, Smith & Company (GRS). To supplement our understanding of current actuarial assumptions and methods we have also referred to the most recent experience study of the System prepared by GRS covering the period July 1, 2007 through June 30, 2011. Specifically, the review process permits CMC to express opinions regarding the accuracy and/or reasonableness of the following:

1. The appropriateness of the demographic and financial information used by the consulting actuary in the valuation of MOSERS’ retirement funds.

   **Opinion:** In the RFP, MOSERS directed that significant resources not be dedicated to a review of the data provided by MOSERS to GRS. However, we felt some effort was appropriate in reviewing how GRS used the data it received from MOSERS. The data provided by MOSERS appears to be clean and complete with few exceptions. Although we noted missing data, such as missing pay, beneficiary date of birth and gender, for a few members, GRS did make assumptions regarding missing information which we believe were appropriate. We believe the impact of the missing information on the valuation results is not material. The data procedures used by GRS were reasonable overall.

   **Recommendation:** None.

2. Whether the actuarial valuation assumptions are reasonable and consistent with generally accepted actuarial standards and practices; are reasonable based on MOSERS’ experience; and are appropriate for MOSERS’ structure and funding objectives.

   **Opinion:** Our review considered the actuarial assumptions used in the most recent actuarial valuation as of June 30, 2012. We have also reviewed the results of the experience analysis covering the period July 1, 2007 through June 30, 2011. While we might have recommended different action on certain assumptions, we believe the set of assumptions used by GRS is reasonable. We do make several suggestions for additional analysis of recommended changes for the next experience study where appropriate.

   *In our opinion, the approach used in setting the assumptions is consistent with generally accepted actuarial standards and practices, and, in particular, the requirements of Actuarial Standards of Practice (ASOP) No. 27 “Selection of Economic Assumptions for*
1. EXECUTIVE SUMMARY

Measuring Pension Obligations” and No. 35 “Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations.”

Recommendation: There are quite a few comments and recommendations for items to be included in the next experience study report (see section 3 of this report for a detailed discussion). Due to the number of comments, we have only included the more significant items below:

1. In general, the experience study report lacked discussion and narrative supporting the specific recommendations made. We believe the report can be greatly enhanced by including narrative along with the numerical analysis.

2. The inflation assumption was lowered from 3.2% to 2.5% as a result of the last experience study. We realize that this level of price inflation rate is reflective of actual inflation over the last twenty years and is also the rate currently priced in the bond market. However, for informational purposes we note that it is at the low end of the range of rates used by large public pension funds. According to the Public Fund Survey published by the National Association of State Retirement Administrators (NASRA), only three systems are using a 2.5% inflation assumption and no system uses a rate lower than that. As GRS noted in their report, “the biggest risk of setting the inflation assumption too low is that members’ pay and COLAs are both influenced by inflation. If actual inflation is higher than assumed, plan benefit and costs will increase faster than expected.” We point this out simply to be sure the Board is comfortable with this risk and it implications.

3. We recommend GRS consider moving to generational mortality with the next experience study. We prefer this approach for reflecting future mortality improvements as it more directly reflects mortality improvements for members most likely to experience it. In addition, it eliminates the need to determine the appropriate amount of margin because the mortality rates are set close to the actual, observed rates and then mortality improvements are projected directly in future years.

4. The four years included in the experience study (July 1, 2007 to June 30, 2011) included the most difficult economic period since the Great Depression. It seems reasonable to expect that such dire economic circumstances could have had an impact on the actual experience observed during the study period, especially for assumptions where the member behavior is generally voluntary like retirement and termination of employment. This fact was not discussed in the experience study report although it was mentioned in the Board presentation. There is no evidence that any special analysis was performed to discover whether the economic conditions during several of the years in the study period might have skewed the observed results. We have
1. EXECUTIVE SUMMARY

clearly seen evidence of the impact of the Great Recession on retirement experience in the experience studies we have recently performed. This is pertinent because the intent of any modification of the current assumptions is to make changes that are expected to be long term trends and not to reflect temporary changes that may have occurred due to unusual events that occurred during the study period.

(5) Judges System: We note that compared to the general working population as a whole, judges tend to have higher education and above average socio-economic conditions, factors that are generally correlated with better mortality. Consequently, we would encourage GRS to consider using a mortality table for judges that reflects relatively better mortality than the table used for general employees in the next experience study.

3. Whether the consulting actuary’s valuation method and procedures are reasonable and consistent with generally accepted actuarial standards and practices; are appropriate for MOSERS’ structure and funding objectives; are in compliance with Governmental Accounting Standards Board (GASB) reporting and disclosure requirements, and are applied as stated by the actuary.

Opinion: We understand MOSERS’ basic funding objective is to avoid the transfer of benefit cost between generations of taxpayers and generate stable contributions as a percent of pay. To accomplish this, the benefit obligations are actuarially funded to systematically pay the cost of the benefit over a member’s career. In our opinion, the actuarial cost methods used by GRS accomplish this objective. The entry age normal cost method is used to fund the benefits and this method is very appropriate given MOSERS’ funding objectives.

The current asset valuation method does provide smoothing of asset gains and losses, and complies with ASOP 44, “Selection and Use of Asset Valuation Methods for Pension Valuations” in our opinion. However, we believe it has some shortcomings and other smoothing methods are preferable. It is our understanding that the actuary and staff are exploring alternative smoothing methods and intend to bring the issue to the Board for consideration before the 2013 valuation work is performed.

The valuation procedures and methods are in compliance with Governmental Accounting Standards Board (GASB) reporting and disclosure requirements.

Recommendation: If the current smoothing method is retained, we recommend that future valuation reports clarify the description of the MOSERS asset valuation method to indicate that the expected return of 8% must be earned on the actuarial value of assets for five years before the actuarial value of assets will be equal to the market value of assets.
1. EXECUTIVE SUMMARY

4. Whether the consulting actuary’s valuation results are reasonable, including analysis of contribution rates and accrued liabilities.

**Opinion:** Overall, the valuation procedures used by GRS are reasonable and we were able to replicate the valuation liabilities within an acceptable range. In fact, the numerical results of the replication were very close. We found nothing in our review that would materially change the valuation results.

**Recommendation:** We recommend several changes in the valuation report to improve its effectiveness in communicating actuarial valuation results. See page 37 for discussion of our recommended changes.

5. Whether the valuation was performed by qualified actuaries and was performed in accordance with principles and practices prescribed by the Actuarial Standards Board.

**Opinion:** We find the valuation was performed by qualified actuaries and was performed in accordance with the principles and practices prescribed by the Actuarial Standards Board.

**Recommendation:** None.

6. Whether the fees paid by MOSERS to the retained actuary are reasonable based on the level of services received.

**Opinion:** We find the fees paid by MOSERS for the level of services received are reasonable with the exception of the experience study report. If our review of the invoices is correct, the fees for the experience study were $89,571. This is considerably higher than the fees we normally see for an experience study for a large system, which tend to run $45,000 to $50,000.

**Recommendation:** The contract between MOSERS and GRS is fifteen years old. It may be a good idea to review the contract to ensure it contains all the language desired by MOSERS. Certain actuarial services and work products (e.g. projection models) are provided now that might not have been anticipated when the original contract was signed. In addition the technology associated with providing and handling employee data has also changed significantly.

In addition, we suggest MOSERS negotiate a fixed fee for the next experience study that is more in line with market rates.
2. REVIEW OF MEMBERSHIP DATA

GRS and MOSERS supplied CMC with active, terminated vested, retired member and beneficiary data as of May 31, 2012. The RFP stated that the auditing actuary should not budget significant resources for the purpose of reviewing the data provide by MOSERS to its retained actuary, so a full reconciliation of the MOSERS and GRS data was not performed. However, the RFP included a requirement for an evaluation of the appropriateness of the demographic and financial information used by the retained actuary in the valuation of MOSERS’ retirement funds. Therefore, as part of CMC’s review we verified the member counts in the MOSERS data matched the counts in the GRS data.

The data provided by MOSERS appears to be clean and complete with few exceptions. We find the data procedures used to determine the number of members valued reasonable given the data supplied by MOSERS and GRS. Where necessary GRS is making assumptions for any missing data and we find these assumptions reasonable.

Since the data is provided as of May 31st instead of June 30th, GRS made two adjustments to project the data to the valuation date. One month of service was given to each active member, and an estimated COLA for 2012 was given to all June retirees who had been retired for at least one year. We find this approach reasonable.

For one of the test lives, the date of birth provided was different than the date of birth in the MOSERS data. The member was age 77, but appeared as age 75 in the sample life output from GRS. According to GRS, their valuation software checks for members who are over age 75 upon plan entry and resets the age downward. In this case, it reset the member’s age to 75. The impact on the valuation is conservative for the individuals affected, but insignificant for the system as a whole if this happens infrequently. GRS estimates this adjustment happened for 10 or fewer members (about 0.02% of the active population) in the June 30, 2012 valuation.
3. ACTUARIAL ASSUMPTIONS

BACKGROUND ON ACTUARIAL ASSUMPTIONS

The actuarial assumptions form the basis of any actuarial valuation or cost study. Since it is not possible to know in advance how each member’s career will evolve in terms of salary growth, future service and cause of termination, the actuary must develop assumptions in an attempt to estimate future patterns. These assumptions enable the actuary to value the amount of benefits earned and to reasonably estimate when these benefits will be paid. Similarly, the actuary must make an assumption about future investment earnings of the trust fund. In developing the assumptions, the actuary examines the past experience and considers future expectations to make the best estimate of the anticipated experience under the plan.

There are two general types of actuarial assumptions:

- **Economic assumptions** – these include the valuation interest rate (expected return on plan assets), assumed rates of salary increase, price inflation, wage inflation, and increases in total payroll. The selection of economic assumptions should conform to ASOP No. 27 “Selection of Economic Assumptions for Measuring Pension Obligations”.

- **Demographic assumptions** – these include the assumed rates of retirement, mortality, termination, and disability. The selection of demographic assumptions should conform to ASOP No. 35 “Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations”.

There was no mention of either ASOP 27 or ASOP 35 in the experience study report prepared by GRS. Although there is no requirement to include such discussion, it seems a natural part of any experience study where changes to the actuarial assumptions are being made since these standards provide professional guidance on our work as actuaries. **We recommend GRS add this content to the next experience study report.**

The mathematical calculations required as part of the experience study, and the resulting graphs, are included in the report. However, there is very little narrative included to provide insight into the analysis performed and explain the changes recommended. The experience study report is the permanent record of the actuarial work performed and, as such, is a very important document. It needs to stand alone and contain all of the information regarding the development of the recommended assumptions. Some of this explanation was included in the Board presentation, but we believe it should also be in the report. **As such, we suggest more explanation be provided in the experience study report regarding the work performed, analysis, and rational for the recommended assumptions.**
ECONOMIC ASSUMPTIONS

The key economic assumptions are the price inflation, the valuation interest rate (expected return on plan assets and forms the basis for discounting future benefit payments), the salary scale (or assumed rates of salary increase), general wage increases (wage inflation), and the increases in total payroll (since unfunded actuarial accrued liabilities are amortized as a percent of payroll). Price inflation impacts both the salary increase and investment return assumptions so the underlying price inflation component in both must be consistent.

Price Inflation: Future price inflation is a component of both the investment return assumption and the salary increase assumption. In addition, because MOSERS’ benefit structure provides cost of living adjustments (COLAs) based partially on actual price inflation this assumption has a direct impact on the valuation results.

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

GRS recommended a range for price inflation of 2.5% to 3.0%. They did not make a specific recommendation for price inflation, but rather included three sets of economic assumptions in the experience study report for Board consideration. The price inflation assumptions in the three scenarios were 2.5%, 2.75% and 3.0%. The Board ultimately adopted a price inflation assumption of 2.5%, although the other economic assumptions differed from those included in GRS’ set of recommended economic scenarios.

While recent historical inflation has been around 2.5%, longer time periods reflect higher price inflation as shown in the following graph which shows price inflation by year (red line) and over rolling 30 year timeframes (blue line). The real question is whether price inflation will eventually revert to the historical long term experience or remain at the lower levels observed in the more recent past. As with most economic assumptions, there are differences of opinion on this issue.
3. Actuarial Assumptions

In addition, a price inflation assumption of 2.5% is on the low end of the range of observed inflation assumptions used by other large public retirement systems. For informational purposes, the following graph shows the inflation assumptions used by the systems included in the 2012 NASRA Public Fund Survey:
3. ACTUARIAL ASSUMPTIONS

Although many economists forecast lower inflation, they are generally looking at a shorter time horizon than is appropriate for a pension valuation. For a longer, similar time frame actuaries often consider the expected increase in the CPI by the Office of the Chief Actuary for the Social Security Administration. In the May 2012 report, the projected average annual increase in the CPI over the next 75 years was estimated to be 2.8%, under the intermediate cost assumptions. The lower cost assumption used a forecast of 1.8% and the high cost assumption was 3.8%.

In summary, this information indicates that the price inflation assumption used by MOSERS, while still reasonable, is at the low end of the range. This assumption impacts the valuation process in many different ways. It affects the investment return assumption, the salary increase assumption, the cost of living assumption and the assumed indexation of pay for disabled members. As such, it has a direct and important impact on the valuation results. As GRS noted in their experience study report on page A-7, “the biggest risk of setting the inflation assumption too low is that members’ pay and COLAs both are influenced by inflation. If actual inflation is higher than assumed inflation, plan benefits and costs will increase faster than expected.” We assume that the Board recognizes this risk and is comfortable with the implications for the Retirement System.

**Investment Return Assumption:** The investment return assumption (also called the valuation interest rate) should represent the long-term rate of return expected on the plan assets, considering the asset allocation, the real rate of return on each asset class, and the underlying inflation rate, all net of expenses paid from the Trust.

The period considered for pension funding represents a long time horizon. In reviewing this assumption, the actuary should consider asset allocation policy, historical returns, and expectations of future returns. The most recent experience study prepared by GRS outlined three different economic scenarios, but did not provide any rational behind why these three scenarios were chosen. The Board ultimately selected a set of economic assumptions that was different than any of the three presented in the experience study report. The MOSERS Board of Trustees, in consultation with GRS, lowered the investment return assumption from 8.5% to 8.0% as a result of the experience study. The 8.0% investment return assumption consists of an assumed real return on assets of 5.5% and price inflation of 2.5%. While the rate of return is lower than the prior assumption of 8.5%, the current assumption of 8.0% actually reflects an increase in the real rate of return of 0.3%, as shown in the following table. Generally, a higher real rate of return indicates a more aggressive assumption.

<table>
<thead>
<tr>
<th>Assumption</th>
<th>Prior Assumption</th>
<th>2012 Valuation Assumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price Inflation</td>
<td>3.2%</td>
<td>2.5%</td>
</tr>
<tr>
<td>Real Rate of Return</td>
<td>5.3%</td>
<td>5.5%</td>
</tr>
<tr>
<td>Investment Return</td>
<td>8.5%</td>
<td>8.0%</td>
</tr>
</tbody>
</table>
3. Actuarial Assumptions

Based on GRS’ analysis in the experience study report, the expected return (50th percentile result) is 7.68% over a ten year horizon. However, this analysis was performed using a 2.75% inflation assumption. Based on the 2.5% inflation assumption, the expected return would be 7.43%. Therefore, the 8.0% assumption adopted by the Board would appear to have a less than 50% chance of being realized – at least in the next ten years. Since one of the three economic scenarios recommended by GRS reflected an 8.0% investment return assumption, we believe some discussion in the report explaining why they believe this is a reasonable assumption and how it complies with ASOP 27 should have been included. There was very little discussion about the investment return assumption in the report despite its importance and cost implications. We do not disagree with the idea that longer term expected returns could be higher than the expected return for the next ten years, but we believe it should have been discussed in the report.

We would point out that although it appears that there is less risk to the system with the reduction in the investment return from 8.5% to 8.0%, the lower cost of living assumption (based on the lower price inflation rate) may create more risk. The Board may want to explore this in more depth with GRS so they fully understand the COLA risk.

It is our understanding that the Board approved an alternative approach to the management of the MOSERS’ portfolio after the experience study report was issued and the expected return with the new approach is 8.5% including alpha. Because the change in asset strategy occurred after the experience study was issued, this information was not and could not have been included in the report. Based on this new information provided by staff, the 8.0% assumption is reasonable.

For general information we are including the following graph which shows the significant change in the distribution of investment return assumptions for large public systems over the last twelve years. We have seen investment return assumptions over 8.5% completely disappear and rates below 7.0% appear. In addition, the percentage of systems using an 8.0% assumption is smaller than any other time in the last twelve years. The median investment return is now 7.75%. Historically, MOSERS’ asset allocation has been different than most of the other large retirement systems in the NASRA survey and MOSERS’ actual investment performance has produced higher returns than other systems. Given the past experience and the new asset strategy recently adopted, we would expect the investment return assumption for MOSERS to be higher than the median of the systems in the NASRA survey, which it is.
3. Actuarial Assumptions

Given the importance of the investment return assumption, we feel more information and discussion should have been provided in the experience study report. For example, the target asset allocation used to develop the expected returns on a forward looking analysis was not included in the report. This is a key piece of information that is necessary in order to evaluate the reasonableness of the recommended investment return assumption. In addition, the historical returns for the System’s performance over the long term (20-25 years) would also have been useful information. Any discussions with MOSERS’ investment staff or their consultants that impacted the recommendations made by GRS should also be included. **We suggest the section of the experience study report on investment return be expanded to provide more analysis and explanation as to how the recommendations were developed.**

**Salary Scale:** The salary scale, or assumed annual rates of salary increase, is another key economic assumption. An analysis of the appropriateness of the salary scale needs to consider two points. First, how do the rates of actual salary increase compare with those expected according to the actuarial assumptions? Second, are the two economic assumptions (interest rate and salary scale) internally consistent with regard to the underlying price inflation assumption?
3. **Actuarial Assumptions**

The salary scale used for MOSERS consists of two components. The first component is the rate of general wage increase also called wage inflation, which consists of price inflation and a productivity component. Wage inflation was lowered from 4.0% to 3.0% as a result of the most recent experience study. The reduction in the wage inflation is largely the result of the decrease in the price inflation, as shown in the following table:

<table>
<thead>
<tr>
<th></th>
<th>Pre-2012</th>
<th>2012 Valuation</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price inflation</td>
<td>3.2%</td>
<td>2.5%</td>
<td>(0.7%)</td>
</tr>
<tr>
<td>Productivity</td>
<td>0.8%</td>
<td>0.5%</td>
<td>(0.3%)</td>
</tr>
<tr>
<td>Wage inflation</td>
<td>4.0%</td>
<td>3.0%</td>
<td>(1.0%)</td>
</tr>
</tbody>
</table>

The wage inflation of 3.0% is higher than the price inflation of 2.5%. Historically, wage inflation has exceeded price inflation over longer time periods, with smaller differences in the more recent past. Therefore, we find the relationship between the two inflation assumptions to be reasonable, i.e. a difference of 0.50%. However, we would note that we find the 3.0% assumption at the lower end of the range typically used by other large public retirement systems which may be appropriate given past wage experience of employees of the state of Missouri. While expectations in the short term are for lower general wage increases, this assumption (as others) should maintain a longer term perspective.

The other component of the salary scale assumption is the merit scale, which measures a combination of seniority and merit increases. The analysis on page C-1 of the experience study report shows the actual versus expected “merit & seniority” pay increases. Because salary data is reported in total (general wage increase and merit components combined), some methodology was used to extract the merit scale experience from the total salary experience observed in the study period. However, there is no discussion on how these increases were culled from the total salary data used in the experience study. It would be helpful if GRS could provide some narrative about the process used to isolate the general wage increase versus the merit scale, as well as how they arrived at their recommendation.

The current merit scale for active members is an age based assumption with increases at age 25 to age 60 that range from 2.9% down to 0.4%. While this merit scale appears to be reasonable assuming the isolation of the merit scale was appropriate, we more often see merit salary scales that are based only on years of service. In our experience, we have typically found salary increases have a stronger correlation to service than they do to age.

*While we find the salary scale assumption to be reasonable, it is worth noting that salary increase assumptions in public plans are more commonly developed based on years of service rather than age. We suggest GRS include analysis of the salary increase patterns based on*
3. ACTUARIAL ASSUMPTIONS

years of service in the next experience study and consider a change to a service based assumption if actual experience supports such action.

Increase in Total Payroll: As part of determining the actuarial contribution rate, the unfunded accrued liability is amortized over an open 30-year period as a level percent of pay. Since total payroll is expected to increase, an assumption is made regarding the rate at which total payroll is expected to increase. The amortization payment is then developed so it will remain level as a percentage of total payroll provided:

➢ The number of active members remains at a constant or stationary level, and

➢ The underlying long-term wage inflation rate of 3.0% is realized.

Based on the other economic assumptions, the 3.0% increase in total payroll assumption is reasonable.

DEMOGRAPHIC ASSUMPTIONS

The demographic assumptions are the assumed rates of retirement, withdrawal (with or without a vested benefit), disability, and mortality (death before or after retirement). Since MOSERS is a large retirement system, the demographic assumptions are based on the system’s own experience. However, it is worth noting that statistical variations will still occur with this size of group. Therefore, we agree with GRS’ comment on page A-2 of the report, “no single 4 year experience period should be given full credibility in the setting of actuarial valuation assumptions.” Periodic experience studies are prepared to review the current actuarial assumptions and revise them as necessary. Such experience studies are generally performed every four years at MOSERS, with the most recent experience study covering the period July 1, 2007 through June 30, 2011. While we find the assumptions to be reasonable based on the observed experience we did have a different perspective on several assumptions, which are discussed in the following paragraphs.

Rates of Retirement: The five years included in the experience study (July 1, 2007 to June 30, 2011) included the most difficult economic period since the Great Depression. It seems reasonable to expect that such dire economic circumstances could have had an impact on the actual experience observed during the study period, especially for assumptions where the member behavior is generally voluntary like retirement and termination of employment. This fact was not discussed in the experience study report although it is mentioned in the Board presentation. There was no evidence that any special analysis was performed to discover whether the economic conditions during several of the years in the study period might have skewed the observed results. We have clearly seen evidence of the impact of the Great Recession on retirement experience in the experience studies we have recently performed. This
3. Actuarial Assumptions

is pertinent because the intent of any modification of the current assumptions is to make changes that are expected to be long term trends and not to reflect temporary changes that may have occurred due to unusual events that occurred during the study period.

Different retirement rates are used for normal retirement (eligibility for unreduced benefits) and early retirement (eligibility for reduced benefit). The normal retirement assumption varies based on when a member first attains retirement eligibility. Separate assumptions apply to the first and second year of eligibility and then another assumption applies in all years after the second year of eligibility. This type of approach to setting retirement assumptions is called a select and ultimate approach and is commonly used in public retirement systems. A summary of the actual, observed experience and the current versus recommended assumptions, for ages 48 through 77, is shown in the table below:

<table>
<thead>
<tr>
<th>Eligibility for Unreduced Benefits</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Using Current Assumptions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual Retirements</td>
<td>1,307</td>
<td>710</td>
<td>3,901</td>
</tr>
<tr>
<td>Expected Retirements</td>
<td>1,582.6</td>
<td>903</td>
<td>4,000</td>
</tr>
<tr>
<td>Actual/Expected Ratio</td>
<td>83%</td>
<td>79%</td>
<td>98%</td>
</tr>
<tr>
<td>Using Proposed Assumptions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual Retirements</td>
<td>1,307</td>
<td>710</td>
<td>3,901</td>
</tr>
<tr>
<td>Expected Retirements</td>
<td>1,417.8</td>
<td>784.2</td>
<td>3,867.3</td>
</tr>
<tr>
<td>Actual/Expected Ratio</td>
<td>92%</td>
<td>91%</td>
<td>101%</td>
</tr>
</tbody>
</table>

The current assumptions for normal retirement were all modified, indicating the actual experience in the current study period was given credibility. However, as discussed above, given the economic conditions in the period, we would have expected to see actual retirement rates lower than expected, which is what occurred. In performing experience studies for our clients we have been analyzing the retirement data separately for each fiscal year to determine if some of the experience is reflective of the economic conditions and not a long term trend. In addition, the normal retirement assumptions were increased rather substantially in the last experience study with the proposed retirement rates for Years 2 and 3 still creating expected retirements below the observed experience (and A/E ratios above 100%). It is best not to be continually playing leapfrog with the assumption, increasing it in one study and then decreasing it in the next. As a result, in evaluating what changes are appropriate given the current experience, we believe that it is important to review the changes made to the assumption in the prior experience study and how closely those adjustments moved the assumption to the actual, observed experience. It is not evident that this type of analysis was included in the MOSERS experience.
3. ACTUARIAL ASSUMPTIONS

study. Furthermore, there was no discussion of the observed experience and the underlying reasons for the recommended changes in the report.

The following table summarizes the retirement experience in the current and prior experience studies.

<table>
<thead>
<tr>
<th>Retirement Eligibility</th>
<th>Actual</th>
<th>Expected</th>
<th>A/E Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year 1</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003-2007</td>
<td>1413</td>
<td>1435.1</td>
<td>98.5%</td>
</tr>
<tr>
<td>2007-2011</td>
<td>1307</td>
<td>1582.6</td>
<td>82.6%</td>
</tr>
<tr>
<td>Total 2003-2011</td>
<td>2,720</td>
<td>3,017.7</td>
<td>90.1%</td>
</tr>
<tr>
<td><strong>Year 2</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003-2007</td>
<td>715</td>
<td>680.2</td>
<td>105.1%</td>
</tr>
<tr>
<td>2007-2011</td>
<td>710</td>
<td>903.0</td>
<td>78.6%</td>
</tr>
<tr>
<td>Total 2003-2011</td>
<td>1,425</td>
<td>1,583.2</td>
<td>90.0%</td>
</tr>
<tr>
<td><strong>Year 3</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003-2007</td>
<td>3,081</td>
<td>2,753.0</td>
<td>111.9%</td>
</tr>
<tr>
<td>2007-2011</td>
<td>3,901</td>
<td>3,999.9</td>
<td>97.5%</td>
</tr>
<tr>
<td>Total 2003-2011</td>
<td>6,982</td>
<td>6,752.9</td>
<td>103.4%</td>
</tr>
</tbody>
</table>

Based on this information, we likely would not have changed the retirement assumptions, at least not as significantly as those recommended by GRS.

In our last audit report, we recommended that the actual experience under the Back DROP on retirement be included as part of the next experience study. The 2011 experience study did not include any evaluation of actual Back DROP experience during the study period. Although we recognize that the current valuation process is conservative in that it assumes the member will elect the most valuable benefit, it would be interesting to have some analysis of the actual experience. We suggest GRS add the analysis of the BackDROP to the next experience study.

We believe the economic conditions that occurred during the study period may have impacted the retirement rates. As a result, we likely would have made fewer or smaller changes to the retirement rates. However, the rates recommended by GRS are reasonable given the observed experience. In the next experience study, we believe it would be useful to consider the experience observed in the prior experience study (i.e. the 2007-2011 Study) and any changes made to the assumptions as a result of that experience before making any recommended changes in the next study (i.e. the 2011-2015 Study).
3. Actuarial Assumptions

Rates of Mortality: One of the most important demographic assumptions in the pension valuation is mortality because it projects how long benefit payments are expected to be made. The longer retirees live and receive benefits, the larger the liability of the system, thus increasing the contributions required to fund the system. In addition, if members live longer than expected based on the assumption, the true cost of future benefit obligations will be understated and contributions would increase as the unfavorable experience unfolds.

Because of potential differences in mortality, healthy retirees, LTD participants, and active members are usually studied separately. The mortality assumption applies to members both before and after retirement. Most often, gender distinct rates are used for non-disabled members since studies continually show that females live longer than males, although that gap has been shrinking according to recent mortality studies. It is also common to use different mortality tables for distinct groups of members who may be expected to have different mortality patterns. For instance, the Judges System could utilize lower mortality rates to reflect that, compared to the broader workforce, judges will tend to be better educated and have higher incomes, two factors which are frequently correlated with better mortality.

It is commonly recognized that rates of mortality have been declining, which means people, in general, are living longer. ASOP 35, “Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations”, was recently revised. The new Standard requires the actuary to include an assumption as to expected mortality improvement after the measurement date. While the new ASOP 35 doesn’t require that the actuary assume future mortality improvements, it does require the actuary to disclose whether future mortality improvements are assumed and reflected in the mortality assumption.

It is an established trend that people are living longer. Therefore, we believe it is appropriate to reflect future mortality improvements in the mortality assumption. Sometimes this is accomplished by including a “margin” in the rates (predicting fewer deaths than are actually occurring in the present observed experience). This approach, by design, results in a ratio of actual to expected deaths of over 100%. Using this methodology, one set of mortality rates is used to anticipate the probability of death at a given age in future years for all members regardless of their current age. For example, the probability of death at age 65 is the same whether the member is currently age 65, reaches age 65 in ten years or reaches age 65 in 30 years. By using mortality rates that understate the expected deaths, it provides room for mortality rates to decline in future years without creating actuarial losses.

Another way to reflect the expectation for long term mortality improvements is to use “generational mortality improvements.” The “generational” mortality table approach selects mortality rates from a series of mortality tables based on the year in which an individual reaches the specified age. So, for example, the mortality rate at age 65 decreases slightly each year in the
future for someone age 65 in that year. As a result, the age 65 mortality rate for a member reaching that age 30 years in the future is lower than the mortality rate for someone reaching that age in the current year, ten years, or twenty years from now. The generational approach is our preferred method for recognizing future mortality improvements in the valuation process because it is more direct and results in the reflection of longer life expectancy for members who are younger, which seems most likely to occur. The RP 2000 Mortality Table, published by the Society of Actuaries for pension valuation purposes, includes a projection scale to use for generational mortality improvements. This is the same projection scale that was used to project future mortality improvements to 2016 to create the current static mortality table that is used in the valuation. The following table is provided ONLY to illustrate how generational mortality differs from a static mortality. If MOSERS moved to a generational approach for mortality the initial table would be selected to closely match the existing observed mortality experience, which would not necessarily be the RP 2000 Mortality Table projected to the year of implementation.

<table>
<thead>
<tr>
<th>Year Reaching Age 60</th>
<th>Life Expectancy</th>
<th>Static RP 2000 Projected to 2016</th>
<th>RP 2000 Generational</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td>82.63</td>
<td>84.63</td>
<td>82.63</td>
</tr>
<tr>
<td>2020</td>
<td>82.63</td>
<td>84.63</td>
<td>82.97</td>
</tr>
<tr>
<td>2030</td>
<td>82.63</td>
<td>84.63</td>
<td>83.77</td>
</tr>
<tr>
<td>2040</td>
<td>82.63</td>
<td>84.63</td>
<td>84.54</td>
</tr>
<tr>
<td>2050</td>
<td>82.63</td>
<td>84.63</td>
<td>85.27</td>
</tr>
<tr>
<td>2060</td>
<td>82.63</td>
<td>84.63</td>
<td>85.95</td>
</tr>
</tbody>
</table>

1 Future mortality improvements are based on Projection Scale AA

GRS uses the first approach where a static mortality table is created that uses expected mortality rates that assume fewer deaths than actually occurred, which will allow for anticipated future improvements in mortality. In the valuation report GRS states that the mortality table provides for a margin of 15% for males and 17% for females (see page 61 of that report). In reviewing the data in the experience study report, the number of actual deaths is compared to the number of expected deaths. The resulting Actual/Expected Ratios (A/E ratios) using the prior mortality assumption were 109% for males (1,378/1,267) and 125% for females (2,001/1,601). One of the challenges of this approach for setting the mortality assumption is determining what level of margin is appropriate. While there is no hard and fast rule regarding the amount of margin that is appropriate, we typically see a range of 10-15%.
3. Actuarial Assumptions

The following table summarizes the information found on page G-3 of the experience study report.

### Male Post-Retirement Mortality

<table>
<thead>
<tr>
<th>Age</th>
<th>Actual Deaths</th>
<th>Expected Deaths</th>
<th>A/E Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Old Assumption</td>
<td>New Assumption</td>
</tr>
<tr>
<td>50-54</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>55-59</td>
<td>60</td>
<td>35</td>
<td>20</td>
</tr>
<tr>
<td>60-64</td>
<td>163</td>
<td>109</td>
<td>75</td>
</tr>
<tr>
<td>65-69</td>
<td>183</td>
<td>166</td>
<td>127</td>
</tr>
<tr>
<td>70-74</td>
<td>201</td>
<td>206</td>
<td>154</td>
</tr>
<tr>
<td>75-79</td>
<td>230</td>
<td>242</td>
<td>202</td>
</tr>
<tr>
<td>80-84</td>
<td>230</td>
<td>235</td>
<td>223</td>
</tr>
<tr>
<td>85-89</td>
<td>173</td>
<td>167</td>
<td>181</td>
</tr>
<tr>
<td>90-94</td>
<td>95</td>
<td>77</td>
<td>95</td>
</tr>
<tr>
<td>95-100</td>
<td>38</td>
<td>23</td>
<td>29</td>
</tr>
<tr>
<td>100 &amp; up</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Totals</td>
<td>1,378</td>
<td>1,267</td>
<td>1,112</td>
</tr>
</tbody>
</table>

Nearly 95% of the exposure for male members occurs between the ages of 55 and 84 (bolded above). Based on the information in the table, the “new assumption” appears to provide a poorer fit to actual experience than the prior assumption at these key ages. The number of actual deaths between age 55 and 84 was 1,067 while the number of expected deaths based on the new assumption was 801, resulting in an A/E ratio of 133%. On page A-4 of the experience study report, the four year history of gains/losses including retiree mortality is shown in a graph. We note that actuarial losses occurred with respect to retiree mortality in all four years. This information conflicts with the results of the analysis performed on a count basis, which would have indicated an actuarial gain (more deaths than expected). Given this information, we understand that GRS performed additional analysis of retiree mortality on a liability weighted basis (reflecting the amount of benefit for each member). That analysis indicated that members with higher benefits were living longer, which impacted GRS’ recommendation with respect to the mortality assumption. Without access to the liability weighted experience it is difficult to provide an opinion on the specific recommendation made in the experience study, but it would support a larger margin in the mortality assumption than seems reasonable solely on a count basis.
3. **Actuarial Assumptions**

While the use of “margin” is acceptable and still widely used, we prefer the “generational” approach for future mortality improvements as it more closely models the longevity improvements more likely to occur, i.e. greater improvements for younger members. If this approach were to be used for MOSERS adjustments to the basic RP 2000 Mortality Table would be needed to better match the current mortality experience of the group. In addition, as with most of the other assumptions, there is no narrative in the experience study report to provide insight into why GRS made their recommendations for changes to the mortality assumption. In particular, the liability weighted experience should have been included, or at a minimum discussed, to provide the foundation for the recommended mortality assumption. Based on conversations with GRS regarding the additional analysis on a liability weighted basis, we believe the mortality assumption is reasonable.

**Rates of Termination:** GRS uses sex distinct select and ultimate withdrawal rates. This means that the withdrawal assumption uses one set of rates (select), which are higher during the first five years of service, and then another assumption (ultimate) if the member remains in employment at least five years. The ultimate termination of employment assumption varies by age alone. This is a common approach used by large systems. We have found that service based rates are sometimes better at reflecting termination rates and encourage GRS to at least review that possibility in their next study.

In this study, GRS made some slight changes to the ultimate rates, while continuing with the select rates. For both the select and ultimate assumptions, the number of actual terminations observed during the study period was close to the expected number. The changes to the ultimate rates are not significant, but rates were actually increased for ages 20 to 39 when actual experience was lower than the assumption. In addition, for ages 50-59, the actual experience was close to the assumed (307 actual terminations versus 312 expected), but the rates were lowered with the resulting expected number of terminations on the recommended assumption of 269. At these ages the recommended assumption appears to provide less of a fit to actual experience than the prior assumption.

Another factor worth mentioning is the same point we mentioned in the discussion of retirement experience. The study period (July 1, 2007 to June 30, 2011) included an unusual period of several years where the economy was very weak. It seems reasonable to expect that these dire economic circumstances could have had an impact on the actual experience observed during the study period, especially for assumptions where the member behavior is generally voluntary including termination of employment. This fact was not discussed in the experience study report and it did not appear that any special analysis was performed to discover whether the economic conditions during several of the years in the study period might have skewed the observed results. We feel that some discussion of the unusual economic period included in the study period should have been mentioned along with the potential impact it may have had, i.e. fewer
employees voluntarily leaving employment. As was discussed earlier in this report, additional analysis of the observed experience by year may have illustrated whether the unusual economic conditions impacted the actual experience. However, overall we believe the termination of employment assumption is reasonable.

**Rates of Disability:** It is not uncommon to find a significant amount of volatility in the actual disability experience from one study period to another given the small probability associated with disability. However, the actual disability experience during the most recent investigation period was close to that expected, in the aggregate, based on the current actuarial assumption. In fact, the A/E Ratio was 98%. Therefore, GRS recommended no change to this assumption. We concur with this conclusion.

**Election of Refunds by Vested Members**

This assumption is used in the valuation to anticipate when vested members terminate employment and elect to receive a refund of employee contributions, thereby forfeiting all rights to a monthly benefit in the future. The assumption only applies to members hired on or after January 1, 2011 (MSEP 2011) because members hired before January 1, 2011 do not make employee contributions to the System.

It is quite common to utilize an assumption in the valuation as to the expected action by vested members if they terminate employment prior to retirement. The assumption used in the valuation for MSEP 2011 members varies depending on each member’s age and years of service. As we understand the assumption, the rates are graded uniformly between 0% and 100% during the period of time that a member is first eligible for vested deferred benefits and exposed to termination rates (before they are retirement eligible).

There is no actual experience to measure as MSEP 2011 has not been in place long enough to have members who have terminated while vested and not eligible for retirement. Therefore, our comments are general in nature. While it makes sense that the probability of electing a refund decreases as a member gets closer to the age at which retirement benefits can start, whether that probability declines uniformly over that period is unknown. In our experience, it is more common for this assumption to be either based on age or years of service. We suggest GRS re-evaluate the use of this assumption when the next experience study is performed.

**Missing Analysis or Comments**

There are several assumptions that are used in the valuation process that were listed in the “Miscellaneous and Technical Assumptions” section of the experience study (page H-1), but no analysis or discussion was included regarding the assumption. It would be helpful to include some discussion of these assumptions especially when changes are being proposed, which was
3. Actuarial Assumptions

not evident. If actual data is not available and recommendations are being made based on the actuary’s judgment, then that should also be stated.

(1) It is assumed that each member will be granted one half year (4 months for 2011 members) of service credit for unused leave upon retirement and military service purchases. It seems that actual experience regarding the amount of unused leave at retirement should be available information that could be included in the experience study. **We recommend that it be added to the next experience study report.**

(2) In the valuation, regular state employees hired before July 1, 2000 are assumed to elect MSEP 2000 prior to age 62 and MSEP on or after age 62. GRS recommended a change in this assumption, but there was no data or analysis in the experience study report. It was included in the Board presentation. In our opinion, the presentation should summarize the findings and recommendations found in the written report and not present new information that was not included in the report. **We recommend GRS include this information in the next experience study report.**

(3) The valuation utilizes an adjustment factor for the actuarial accrued liability for MSEP 2000 retirees because the alternate forms of payment contain a slightly negative subsidy. There are also load factors applied to approximate the additional liability for pre-retirement survivor benefits for the spouse of any terminated vested member. It appears that both of these assumptions were changed in the experience study, but the report only states the assumption, with no indication that a change has been recommended and why. **GRS should clearly identify the recommended change and provided the reason for their recommendation.**

(4) GRS recommended that the marriage assumption for death after retirement be reduced from 80% to 75%. Again, there was no mention of any analysis leading to that recommendation and no supporting evidence. **We recommend that GRS include the analysis performed in the experience study to support their recommendation.**

JUDGES SYSTEM

The Judges System utilizes some of the same assumptions as the general employees plan discussed earlier in this section. In particular, the economic assumptions are the same. However, certain demographic assumptions are different for the Judges. Our comments on the set of actuarial assumptions recommended in the experience study report are set out below.

Disability

Because of the small membership in the system, developing assumptions from actual experience can be challenging. Further, judges often exhibit employment patterns that differ from other groups in that once hired, they tend to remain as judges until retirement. We note that over the four year period, there was one disability retirement and one pre-retirement death. In light of
3. ACTUARIAL ASSUMPTIONS

this, we are not sure the detail considered in the Experience Study is meaningful or justified. An assumption of no disability could be justified since it would have been exactly right 3 out 4 years. There are no current disabled retirees, so this sparse occurrence of disabilities does not appear to be new occurrence. In the next experience study, we suggest considering the elimination of the disability decrement since it cannot be credibly studied in this group and is so infrequent as to have only an immaterial impact on the liability calculations in the valuation. While pre-retirement death is also rare, the ability to use standard tables based on the broad population at least provides for a more credible assumption.

Early Retirement and Disability

On page A-2, the commentary for both early retirement and disability state that there was no experience for females. In both cases, the detail later in the report indicates that there were individuals who could have left the system under these decrements, although none did. Thus, the experience was an effective rate of 0%. We suggest that the phrasing indicate that there were no decrements rather than no experience.

Salary Increase – Merit Scale

The analysis of merit/seniority and pay increases does not indicate whether the increases shown are computed using actual wage inflation, or expected wage inflation. Such disclosure would be helpful in understanding the results. We also note that during this time period, many governments across the country were granting very limited pay increases, or even freezing pay. This makes the result of merit increases in excess of expected increases a surprising finding. We believe it would be useful for GRS to provide some commentary regarding the unusual economic environment in effect throughout most of the study period and indicate what other factors (e.g. a state program to make judges salaries more competitive) might be affecting salary increases.

Retirement

The retirement experience is analyzed separately for males and females. Because of the small population size and the homogeneity of jobs held by members in the system, we suggest that GRS consider the use of the same assumptions for both males and females which would result in a greater degree of credibility.

Termination of Employment

Similarly, we believe that the withdrawal decrement analysis could be combined for males and females, especially since a single set of rates was ultimately adopted. We agree with the adoption of a service based scale, noting that this often fits actual employment patterns well.
3. ACTUARIAL ASSUMPTIONS

Judges typically have a low rate of termination before retirement, as is confirmed by this study. Thus, simplifying the assumption to 1% for all years might reduce complexity and be equally consistent with the observed results. We suggest GRS consider this when the next experience study is performed.

Mortality

For retiree mortality, we agree that the relatively limited number of lives results in low credibility. We do note, however, that the proposed rates reflect generally higher incidence of death than observed, especially for males in the range of age 65 to 80, a key segment of the rates from a liability perspective. We note that, compared to the general working population as a whole, judges tend to have higher education and above average socio-economic conditions, factors generally correlated with better mortality. Consequently, we would encourage GRS to consider using a mortality table for judges that reflects relatively better mortality than the table used for general employees in the next experience study.

Miscellaneous Assumptions

Under miscellaneous assumptions, we note that GRS proposes to change the probability of marriage from 80% to 70%. Although we do not find the 70% number unreasonable, some explanation as to how GRS arrived at this recommendation would be helpful.
4. ACTUARIAL METHODS

ACTUARIAL COST METHOD

For all pension plans, whether defined benefit or defined contribution, the basic retirement funding equation is:

\[ C + I = B + E \]

Where:

- \( C = \) employer and member contributions
- \( I = \) investment income
- \( B = \) benefits paid
- \( E = \) expenses paid from the fund, if any.

As can be seen from the formula, for a given level of benefits and expenses the greater “I” is, the smaller “C” is. This is the underlying reason for advance funding a pension plan, and historically investment income pays for 75% - 80% of the benefit dollars received by plan participants. In other words, for every dollar paid to a participant only 20 – 25 cents comes from contributions.

Of course, the problem with the formula is that in order to figure out exactly how much to contribute, the plan would have to be closed to new members and allowed to operate until all retirees were deceased. At that point, the benefits and expenses actually paid out, and the investment income actually earned would be known and, using the equation above, the true cost could be determined. Since the vast majority of plans are ongoing and have no intention of closing, and since even with a closed plan it takes a very long time before all benefits are finally paid out, plan sponsors hire actuaries to estimate the cost of their plans and to create a budget for systematic contributions to meet that cost.

In order to determine the contributions needed, the actuary’s first step is to estimate on a given date (the valuation date) the value of all benefits (and expenses) that will be paid to the existing active and retired membership over their remaining lifetimes based on the plan’s current benefit structure. This estimation requires the use of assumptions regarding both future events (termination, disability, retirement, death, etc.) and future economic conditions (return on assets, inflation, salary growth, etc.). The MOSERS assumptions were covered in the previous section.

By combining the future events assumptions and the salary growth assumption, the actuary generates an expected benefit payment stream. In other words, a string of annual payments expected to be made to the current active and retired members from the valuation date until all members are no longer living. Then the actuary applies the investment return assumption to
discount each year’s payments to the valuation date, creating the present value of all future benefits or the total liability of the plan.

The difference between the total liability and the current assets of the plan represents the present value of future contributions (PVFC) that have to be made by either members or the plan sponsor. Usually the plan sponsor cannot contribute the entire difference in one year, but rather desires a relatively smooth contribution pattern over time that also meets any external constraints. In order to budget for the PVFC, the actuary applies an actuarial cost method. There are several acceptable cost methods, but it’s important to recognize that they are nothing more than budgeting tools.

Different actuarial cost methods can provide for faster funding earlier in a plan’s existence, more level funding over time, or more flexibility in funding. The choice of an actuarial cost method will determine the pattern or pace of the funding and, therefore, should be linked to long term financing objectives of the fund and benefit security considerations.

The actuarial cost method used by MOSERS as required by State statute is entry age normal. This cost method determines the normal cost as a level percentage of pay which, if paid from entry into the plan to the last assumed retirement age, will accumulate to an amount sufficient to pay the expected benefit. An additional cost is determined by amortizing the unfunded actuarial liability over an open 30-year period as a percentage of increasing payroll and is added to the normal cost to determine the total required contribution. Actuarial gains and losses adjust the unfunded liability each year.

The actuarial cost method employed by the GRS actuary will systematically fund the prospective pension benefits on an actuarially sound basis if all of the actuarial assumptions are realized. *We have reviewed the application of the cost method and the amortization methodology, and in our opinion, the procedures employed are reasonable.*

**ASSET VALUATION METHOD**

Since the purpose of actuarial funding is to build up an asset pool (remember the importance of “I” in “C + I = B + E”) actuaries need to value the current asset pool on each valuation date. The market value could be used but it would tend to create too much volatility from valuation date to valuation date, and a single day’s measurement is not necessarily indicative of the true underlying value of the investments held by the plan. In addition, as outlined in State statute, a primary funding policy goal is to have contributions which will remain approximately level as a percent of active member payroll from year to year. Large market value fluctuations make this goal difficult to achieve. Thus most actuaries use an asset valuation method which smoothes out these fluctuations in pursuit of achieving level contributions. A good asset valuation method places values on a plan’s assets which are related to current market value but which will also
4. ACTUARIAL METHODS

produce a smooth pattern of costs. This is a question of balancing fit (measured against market value) and smoothness.

Neither book nor market value assets is generally felt to be appropriate in determining the actuarial contribution rate for an ongoing pension plan. Book value produces smooth predictable employer contributions, but it ignores sizeable appreciation and is not a good measure of the fund’s true value (i.e., a poor fit to market value). On the other hand, market value is a realistic current measure of the fund but, on a long-term basis, one day’s market value may not be a very meaningful figure for a pension fund. Furthermore, sharp short-term swings in market value can result in large fluctuations in the computed employer contributions required to fund the plan (i.e., not very smooth).

The goal of the actuarial asset valuation method is thus to smooth or reduce investment market fluctuations. This is particularly important during periods of volatile capital markets in which abrupt changes in asset values, when factored into the funding valuation, produce sudden unnecessary changes in contribution levels. In this case, “unnecessary” implies that the change in asset values is not necessarily a true revaluing of the assets involved but rather a fluctuation reflecting a current economic climate or a short-term reaction to specific news.

In our opinion, desirable characteristics of an actuarial asset valuation method include the following:

- The method should be simple to operate. It should be readily calculable from financial statements.
- The method should be easy to explain to all interested parties.
- The theoretical underpinnings should be solid and not produce a long-term lag to the fair value of assets. The value produced should account for market values.
- The method should smooth the effect of market fluctuations.
- Investment decisions should not be affected by the actuarial asset valuation method, and vice versa.
- The value produced should be realistic; the price tag placed on assets should be sensible and should not cause other variables to be adjusted to account for unrealistic asset values.

**MOSERS Asset Valuation Method:** The asset valuation method used by GRS in the valuation is not a method commonly used by other major actuarial firms who work in the public sector. The current method smooths the difference between the actual return on the market value of assets
4. Actuarial Methods

and the expected return on the actuarial value of assets over five years. Twenty percent of the difference between the actual return on market value and the expected return on the actuarial asset value is recognized in the actuarial value of assets each year. If the actual rate of return on the market assets equals the assumed return rate of 8.0% for several years, the actuarial and market value of assets will grow closer together, but will not converge. In order for the market value and actuarial value of assets to be equal in five years, the 8% rate of return would have to be earned on the actuarial value of assets.

One of the most commonly used asset smoothing methods is similar in concept to the MOSERS’ methodology except it determines the dollar amount of the difference between the actual and expected returns, both based on the market value of assets, and then recognizes that difference equally over five years. Using this asset valuation method, the actuarial value of assets would be equal to the market value of assets if the actual return was equal to the expected return (8.0%) for five consecutive years.

While the current asset valuation method does smooth the gains and losses due to actual investment returns on market value as compared to the expected return on actuarial value of assets, we find the method to be non-intuitive and difficult for most people to clearly understand the mechanics of the method and, therefore, to anticipate the results. We do not believe the current method is easy to explain to interested parties and, in fact, may be misunderstood if it is described as “five year smoothing”.

Compliance with ASOP 44

Actuarial Standard of Practice Number 44, “Selection and Use of Asset Valuation Methods for Pension Valuations”, provides guidance to the actuary when selecting an asset valuation method for purposes of a defined benefit pension plan actuarial valuation. When considering the use of an asset valuation method other than market value, ASOP 44 states the actuary should select an asset valuation method that is designed to produce actuarial values of assets that bear a reasonable relationship to the corresponding market values. Further guidance states that the asset valuation method must satisfy both of the following criteria:
4. Actuarial Methods

**Test One**

(a) The asset values fall within a reasonable range around the corresponding market value.

AND

(b) Any differences between the actuarial value of assets and the market value of assets are recognized within a reasonable period of time.

**Test Two**

In lieu of satisfying both (a) and (b) above, an asset valuation method meets ASOP 44 requirements if, in the actuary’s professional judgment, the asset valuation method either:

(i) Produces values within a sufficiently narrow range around market value OR

(ii) Recognizes differences from market value in a sufficiently short period.

Several of the terms in the criteria of ASOP 44 such as “reasonable” and “sufficiently narrow” are not well defined. As a result, actuaries can differ in their opinion on these matters. As we consider the current asset valuation method used by MOSERS in light of ASOP 44, we believe the corridor in place ensures the asset smoothing method complies with ASOP 44 as it should satisfy Test Two of the requirements of ASOP 44.

The description of the asset smoothing method as it appears on page 62 of the valuation report is: “Valuation assets recognize assumed investment return fully each year. Differences between actual and assumed investment return are phased-in over a closed five year period. Valuation assets are not permitted to deviate from the market value by more than 20%.” The smoothing method recognizes the difference between the actual return on the market value of assets and the expected return on the actuarial value of assets. In our opinion, this description does not clearly identify that point. **We recommend that the description of the asset valuation method be revised to more accurately state the calculation methodology for determining the actuarial value of assets.**

**Conclusion:** The current asset valuation method does provide smoothing of asset gains and losses, and complies with ASOP 44, “Selection and Use of Asset Valuation Methods for Pension Valuations” in our opinion. However, we believe it has some shortcomings and other smoothing methods are preferable. It is our understanding that the actuary and staff are exploring alternative smoothing methods and intend to bring the issue to the Board for consideration before the 2013 valuation work is performed.
AMORTIZATION OF UNFUNDED ACTUARIAL ACCRUED LIABILITY

The unfunded actuarial accrued liability is amortized over an open 30 year period with payments that are determined as a level percent of payroll. As a result, the amortization payment is less than the interest on the unfunded actuarial liability. The result is a continually increasing dollar amount of unfunded actuarial accrued liability. As the table on pages 71-72 of the valuation report illustrate, the dollar amount of the UAAL increases from $2.896 billion to $4.525 billion over the thirty year period. That same table provides two other relevant measurements, i.e. the dollar amount of the UAAL, adjusted for wage inflation, and the UAAL as a percent of covered payroll. When the dollar amount of the UAAL is adjusted for wage inflation, it decreases from $2.896 billion to $1.882 billion and as a percent of covered payroll the UAAL declines from 151% in 2012 to 98% in 2042. We believe it would be helpful to include the funded ratio in this exhibit. The concern with an open thirty year amortization period is usually whether acceptable progress is being made in funding the System. Given the information provided in the valuation report, we assume the Board has studied the long term funding implications of an open thirty year amortization period and is comfortable with the funding results.

The new GASB standards are forcing many retirement systems whose current funding policy is based on current GASB standards to analyze their current funding policies and develop new policies. There is broad interest in the amortization of the unfunded actuarial accrued liability with groups such as the Government Finance Officer Association (GFOA) weighing in. There are also actuarial groups from the Conference of Consulting Actuaries and the American Academy of Actuaries who are meeting to discuss pension funding with the intent to define “best practices” for funding public retirement systems. There seems to be a strong opinion that a thirty year amortization period is too long, especially if it is open. For example an open 30 year amortization is categorized as an “unacceptable practice” in the “Actuarial Funding Policies and Practices for Public Pension and OPEB Plans” recently published by the California Actuarial Advisory Panel. The ultimate decision on how to amortize the UAAL remains with the Board, but they should be aware that the winds of change are at work and it is likely an open thirty year amortization will not be viewed positively in the future.
5. ACTUARIAL VALUATION RESULTS REVIEW

This section of our review discusses the following aspects of the actuarial valuation results:

- Reasonableness of the results of the valuations performed as of June 30, 2012.
- Content of the actuarial reports with regard to disclosure of actuarial assumptions, plan provisions, data considered, actuarial methods, valuation procedures, assets, and other information that another actuary, unfamiliar with the situation, would require to appraise the finding.
- Adequacy of the information provided in the actuaries’ reports with regard to analysis of gains and/or losses and the effect of changes in plan provisions, actuarial assumptions, and actuarial methods.
- Compliance with disclosure requirements of the Governmental Accounting Standards Board.

REASONABLENESS OF THE ACTUARIAL VALUATION RESULTS

Generally accepted actuarial standards and practices provide actuaries with the basic mathematics and the framework for calculating the actuarial results. When it comes to applying those actuarial standards to complex calculations, differences may exist due to individual opinion on the best way to make those complex calculations. Differences may also arise from the actuarial software used to make these calculations, especially in the allocation of liabilities between past and future service for active members. Although these factors may lead to differences in the calculated results, these differences should not be material. Generally, differences in actuarial liabilities of 5% or less are considered reasonable.

As part of the actuarial audit, Cavanaugh Macdonald received detailed output that illustrated the projected benefit payment streams that were valued for individual members of the plans by the GRS valuation software. The actual output from their valuation software was not provided, but presumably benefit payments were directly copied from the output. The review of these “sample” or “test lives” permits the auditing actuary to dig into the calculation framework used by the software to produce the valuation results. We focused heavily on the sample lives that were members of MSEP2011 as that plan was not in place when the prior audit was performed.

Based on the results of our review, overall, we find the actuarial liabilities and the employer contributions to be reasonable.

GRS loads the liabilities for a potential spouse’s benefit should a terminated vested member die during the deferral period. They do this because their coding currently values the spousal benefit starting at the member’s retirement age rather than at the member’s death prior to retirement. We calculated this portion of the benefit directly in our valuation software rather than using the
load and obtained liabilities that are lower than GRS. *We recommend that GRS review their methodology and consider reducing this load if they are not able to value the benefits directly.*

Our measurement of the liability for current disabled members (LTD members) is notably lower than that of GRS. In discussing this with GRS, we learned that they value the liability by first calculating the liability with a salary projection that starts with the salary on the data record (from the time of disability) and increases with normal salary progression. They then value the liability again using the same starting point, but no salary progression. The difference of these two amounts is then added to the first amount as an estimate of the impact of the indexing of salary increases between the date of disability and the present. In contrast, we applied the wage inflation assumption from the date of disability through retirement. Both of these methods are imprecise, but since the change in salaries from disability to the present is unknown, some estimation method must be utilized. While the GRS method produced a larger result and thus appears to be conservative, we find it arbitrary and not necessarily reflective of the past salary indexing. *We encourage an examination of the valuation methodology for LTD members to see what better estimation techniques might be available with the existing data.*

In the following table we present a comparison of the June 30, 2012 valuation results calculated by GRS and by CMC. *As mentioned before, the replication results are a very close match to the valuation results produced by GRS. It is worth noting that such a close match on all key valuation measurements rarely occurs.*
### 5. Actuarial Valuation Results Review

**MOSERS**

Comparison of June 30, 2012 Valuation Results

<table>
<thead>
<tr>
<th></th>
<th>(A) CavMac</th>
<th>(B) GRS</th>
<th>A/B</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Active Valuation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number</td>
<td>51,332</td>
<td>51,332</td>
<td>100.0%</td>
</tr>
<tr>
<td>Payroll</td>
<td>$1,864,069,493</td>
<td>$1,864,069,493</td>
<td>100.0</td>
</tr>
<tr>
<td>Average Pay</td>
<td>$36,314</td>
<td>$36,314</td>
<td>100.0</td>
</tr>
<tr>
<td>Present Value of Future Benefits</td>
<td>$5,438,089,184</td>
<td>$5,393,224,327</td>
<td>100.8</td>
</tr>
<tr>
<td>Actuarial Accrued Liability</td>
<td>$4,455,307,495</td>
<td>$4,414,905,648</td>
<td>100.9</td>
</tr>
<tr>
<td><strong>Retiree Valuation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number</td>
<td>37,308</td>
<td>37,308</td>
<td>100.0</td>
</tr>
<tr>
<td>Total Benefits</td>
<td>$558,582,105</td>
<td>$558,582,105</td>
<td>100.0</td>
</tr>
<tr>
<td>Average Benefit</td>
<td>$14,973</td>
<td>$14,973</td>
<td>100.0</td>
</tr>
<tr>
<td>Actuarial Accrued Liability</td>
<td>$5,702,523,603</td>
<td>$5,748,985,566</td>
<td>99.2</td>
</tr>
<tr>
<td><strong>Inactive Deferred Valuation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number</td>
<td>19,119</td>
<td>19,119</td>
<td>100.0</td>
</tr>
<tr>
<td>Actuarial Accrued Liability</td>
<td>$631,339,374</td>
<td>$629,760,363</td>
<td>100.3</td>
</tr>
</tbody>
</table>

### Summary of Principal Results

<table>
<thead>
<tr>
<th></th>
<th>(A) CavMac</th>
<th>(B) GRS</th>
<th>A/B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employer Normal Cost (w/adm.exp.)</td>
<td>8.13%</td>
<td>8.04%</td>
<td>101.1</td>
</tr>
<tr>
<td>UAL Payment (30 year amortization)</td>
<td>9.59</td>
<td>9.60</td>
<td>99.9</td>
</tr>
<tr>
<td>Member Contributions</td>
<td>(0.66)</td>
<td>(0.66)</td>
<td>100.0</td>
</tr>
<tr>
<td>Employer Contribution Rate</td>
<td>17.06%</td>
<td>16.98%</td>
<td>100.5</td>
</tr>
<tr>
<td>Total Present Value of Future Benefits</td>
<td>$11,771,952,161</td>
<td>$11,772,395,758</td>
<td>100.0</td>
</tr>
<tr>
<td>Total Actuarial Accrued Liability</td>
<td>$10,789,595,974</td>
<td>$10,793,651,577</td>
<td>100.0</td>
</tr>
<tr>
<td>Actuarial Value of Assets</td>
<td>$7,897,167,203</td>
<td>$7,897,167,203</td>
<td>100.0</td>
</tr>
<tr>
<td>Unfunded Accrued Liability</td>
<td>$2,892,428,771</td>
<td>$2,896,484,374</td>
<td>99.9</td>
</tr>
<tr>
<td>Funding Ratio</td>
<td>73.16%</td>
<td>73.20%</td>
<td>99.9</td>
</tr>
</tbody>
</table>
5. ACTUARIAL VALUATION RESULTS REVIEW

CONTENT OF THE ACTUARIAL REPORTS

The American Academy of Actuaries has stated, “The form and content of any actuarial communication should meet the needs of the particular circumstances, taking into account the knowledge and understanding of the users and the actuary’s relationship to the users”. Therefore, the form and content of an actuarial report may vary considerably from one actuary or plan to another.

However, the Academy has also issued a number of Actuarial Standard of Practice which deal with measuring pension obligations and communicating the results (ASOP No. 23, 27, 35, 42 and 44). Those standards list specific elements to be included, either directly or by reference to prior communication, in pension actuarial communications. Some of the elements would not be pertinent in all communications, but since an actuarial valuation report is the most complete picture of the actuarial status of the plan, all the elements listed should be covered in the report, even if only briefly.

The following is a list of the specific elements to be included:

- The name of the person or firm retaining the actuary and the purposes that the communication is intended to serve.
- An outline of the benefits being discussed or valued and of any significant benefits not included in the actuarial determinations.
- A statement as to the effective date of the calculations, the date as of which the participant and financial information were compiled, and the sources and adequacy of such information.
- A summary of the participant information, separated into significant categories such as active, retired, and terminated vested. Actuaries are encouraged to include a detailed display of the characteristics of each category and a reconciliation of the prior reported data.
- A summary of asset information and derivation of the actuarial value of assets. Actuaries are encouraged to include an asset summary by category of investment and a reconciliation of prior reported assets showing total contributions, benefits, investment return, and any other reconciliation items.
- A description of the actuarial assumptions and cost method and the asset valuation method. Changes in assumptions and methods from those used in previous communications should be stated and their effects noted. If the actuary expects that the long-term trend of costs
resulting from the continued use of present assumptions and methods would result in a significantly increased or decreased cost basis, this should also be communicated.

- A statement of the findings, conclusions, or recommendations necessary to satisfy the purpose of the communication and a summary of the actuarial determinations upon which these are based. The communications should include applicable actuarial information regarding financial reporting. Actuaries are encouraged to include derivation of the items underlying these actuarial determinations.

- A disclosure of any facts which, if not disclosed, might reasonably be expected to lead to an incomplete understanding of the communication.

We have reviewed the actuarial valuation reports (General Employees and Judges) prepared by GRS as of June 30, 2012. The reports contain the majority of the specific information required by the Academy.

The following comments and suggestions are for the General Employees report. Specific changes for the Judges Report are summarized at the end of this section. We believe these changes will improve the effectiveness of the reports in communicating the actuarial valuation results to interested parties:

1. The June 30, 2012 valuation results are used to set the contribution rates for fiscal year ending June 30, 2014. As a result, the unfunded actuarial liability at June 30, 2012 is rolled forward to June 30, 2013 and the UAL contribution rate is based on the estimated June 30, 2013 UAL amount. We find this approach to be reasonable, but there is no exhibit in the valuation report that substantiates the UAL contribution rate of 9.60%. It simply “appears” with no direct calculation of the rate. We were provided with the calculation upon request, but we strongly feel it is an important piece of information that should be included as an exhibit in the valuation report.

2. On page 3 of the valuation report, the employer contribution rate is developed for fiscal year end 2014. Section A reflects the normal cost rate, section B the member contribution rate, section C the employer normal cost rate and section D the payment on the unfunded actuarial accrued liability. Our concern is with the presentation of the normal cost rate and member contribution rate in sections A and B, which is different than the standard approach observed in most other valuation reports. Typically the “cost” of the refund feature in the plan design (employees are entitled to receive their employee contribution balance upon termination) is included as part of the total normal cost rate instead of being offset against the employee contribution rate. For MOSERS this only impacts the normal cost rate for the “Post-2010 Hires” as members hired before 2010 do not make employee contributions to the system. By splitting out the refund portion of the normal cost rate and using it to reduce the
5. Actuarial Valuation Results Review

member contribution rate, the normal cost rate appears to be 5.84% instead of 7.08%. While the employer normal cost rate is 3.08% under either calculation approach, we believe that the current approach can be misleading as there is a tendency to compare the normal cost rates for the different benefit structures, especially when they are side by side. As they appear in the valuation report, the total normal cost rate for the “Post-2010 Hires” is understated. The cost of the benefit structure is 7.08% of which employees are contributing 4.00%. Unless the Board believes the current approach is preferable for some reason, we recommend the calculation presentation be changed as set out in Column (2) below:

<table>
<thead>
<tr>
<th></th>
<th>(1) 6/30/12 Valuation Report</th>
<th>(2) Proposed Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Normal Cost</td>
<td>5.84%</td>
<td>7.08%</td>
</tr>
<tr>
<td>B. Member contributions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1) Member contribution rate</td>
<td>4.00%</td>
<td>4.00%</td>
</tr>
<tr>
<td>(2) Refunds</td>
<td>(1.24%)</td>
<td>*</td>
</tr>
<tr>
<td>(3) Total</td>
<td>2.76%</td>
<td>4.00%</td>
</tr>
<tr>
<td>C. Employer Normal Cost</td>
<td>3.08%</td>
<td>3.08%</td>
</tr>
<tr>
<td>(A) – (B3)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. The last sentence of the note at the bottom of the Development of Actuarial Value of Assets page states: “If assumed rates are exactly realized for four consecutive years, the actuarial value will become equal to market value.” To the average reader, this would be interpreted as 8% on the market value of assets. However, the actuarial value and the market value will not become equal under the current asset valuation method if the 8% assumed rate of return is earned on the MARKET value of assets. They only converge if 8% is earned on the ACTUARIAL value of assets. If the current asset smoothing method is retained for the 2013 valuation, we suggest GRS add clarifying language to that statement to avoid confusion and misunderstanding.

4. We note that the breakdown of the normal cost rate by decrement on page 3 of the valuation report does not indicate a cost for vested withdrawal benefits. We suggest that this be explicitly included. If it cannot be separately identified, then that should be noted as well as which component of the normal cost includes that the vested terminated benefit cost.

5. We suggest presenting a breakdown of active member data by membership: MSEP/MSEP 2000 and MSEP 2011. As more members are covered under MSEP 2011 this will be important information to include in the valuation.

6. On page 15, the discussion on the loss indicates that the largest single identifiable source is pay increase above expected (and thus a loss). The detail on page 17 indicates that salary
experience was actually a source of gain and notes some identifiable sources that were more substantial, so we believe this comment was incorrectly included. GRS has confirmed this.

- (7) The mortality table used in the valuation is disclosed on page 61 of the report as “the RP 2000 mortality table, projected to 2016 with Scale AA”. The RP 2000 Tables actually include separate tables for Healthy Annuitants and for Employees (based on people still working) as well as a Combined Table. We matched the probability of death provided by GRS by using the Combined Table and so presume that it is the table being used. We believe the description of the mortality table should specifically state that it is the Combined Table.

- (8) We would recommend the addition of some detail regarding the COLA assumption on page 61. An explanation that the COLA is 4% for 12 years, 3.06% for the next year (to get to 65% cumulatively), and then 2.0% thereafter would provide some insight for the reader of the report.

- (9) On page 65 of the valuation report, there is a double asterisk in the heading for MSEP 2011 but no corresponding footnote. Either the footnote should be added or the double asterisk should be deleted.

- (10) The table showing the active member payroll, the UAAL, and the UAAL payment as a dollar amount and a percent of payroll on page 71 is very helpful given the fact the UAAL is being amortized over an open 30 year amortization period. We would suggest adding the funded ratio to this exhibit which would provide another important relationship between the assets and actuarial liabilities over time.

- (11) The methodology for calculating the disabled member liability should be disclosed. This is especially important since the methodology is unique and would not likely be matched by another actuary. We further suggest disclosing the salary index assumption for actives who become disabled in the future.

- (12) Page 66 contains a disclosure of some factors relating to pre-retirement survivor benefits for deferred members. Additional explanation should be included to explain how and why these factors are used since this is not a common actuarial assumption.

- (13) The marriage assumption for terminated vested members is 80%. This is different than the assumption for actives or retired members and is not disclosed in the valuation report.

- (14) The GRS valuation report states that the disability and pre-retirement death decrements do not operate in the first five years of service. However, in the sample life output provided to us by GRS it appeared that these decrements were in effect from the date of hire. This
5. ACTUARIAL VALUATION RESULTS REVIEW

does not have a material impact on the valuation results, but GRS should adjust the report to reflect what is actually occurring in the valuation process.

GRS provided several exhibits in the MOSERS valuation report that are not typically included in a standard valuation report. We feel these exhibits (the sensitivity analysis on page 13, the historical analysis of gains and losses on page 19, and the various exhibits in the Cash Flow section) provide very important information and are quite helpful in evaluating the actuarial status of the plan. On the historical analysis of gains and losses on page 19, we would suggest splitting the COLA and the retired lives amount to better identify mortality trends.

JUDGES REPORT

(1) The data exhibit on page 10 suggests that all retirees are receiving a 50% Joint and Survivor benefit, even though not all of them were married at retirement and some have since been predeceased by their spouses. Correctly identifying the current effective form of payment would allow this exhibit to be more useful.

(2) On page 26, there is a table labeled Single Life Retirement Values. This description is inaccurate since the factors on the left are based on a 50% Joint and Survivor Payout. Correcting the table title would be appropriate.

(3) At the bottom of page 26 is a table purporting to contain future life expectancies. The values in it are clearly wrong and should be corrected.

(4) There is no discussion regarding the funded status of the plan. While the funded ratio is extremely low, this is because the plan has only recently changed from being a pay-as-you-go plan to a prefunded plan. Consequently, the current funded ratio is a tribute to the progress made. Without some discussion regarding this, however, it would be easy for many readers to draw the conclusion that the plan is being underfunded. We recommend that sufficient commentary be included to allow at least another actuary (if not a lay reader) to understand the current funded status without having to look at additional resources.

COMPLIANCE WITH GASB

We have reviewed the Supplemental Disclosure Information in the June 20, 2012 valuation reports and we find the disclosure information to be in complete compliance with the requirements of Statement 25 and 27 of the Governmental Accounting Standards Board (GASB).
6. Qualified Actuaries

MOSERS has asked we assess whether the valuation was performed by qualified actuaries and was performed in accordance with principles and practices prescribed by the Actuarial Standards Board.

*We confirm the valuation was performed by qualified actuaries and was performed in accordance with the principles and practices prescribed by the Actuarial Standards Board, including conformance with recent amendments to ASOP No. 4, 27 and 35, as well as new ASOP No. 44.*
7. REVIEW OF ACTUARIAL FEES

In the RFP, MOSERS requested we express an opinion whether the fees paid by MOSERS to the retained actuary are reasonable based on the level of services received.

Our review is based on information provided to us by MOSERS, including:

- A summary of valuation and other retainer fees for the last three years
- Fees for other services for the last three years
- Fees for the most recent experience study of MOSERS

As the auditing actuary we do not have extensive knowledge into the complexity of the System and the level of actuarial consulting services routinely used by MOSERS. In our experience the amount of consulting time can vary dramatically from client to client. While we can provide a general opinion on whether GRS’ fees are reasonable based on our experience with comparable systems and current market fee levels, the only way for the Board to assure themselves that the current fees are truly reasonable is to issue a RFP for actuarial services and see how the market prices the services.

The fees for “other services” can vary widely from year to year depending on the services required, such as the level of proposed legislation activity. In our experience the level of fees for “other services” is reasonable. We would note that the top hourly rate of $575 for FY 2011 and FY 2012 appears somewhat high, but the rate dropped considerably to $400 for FY 2013. This level is more in line with the other top hourly billing rates we see in the marketplace.

The current valuation services fees of approximately $110,000 and annual miscellaneous fees of $49,000 are reasonable given the size and complexity of MOSERS, compared to the range of rates currently charged by other actuarial firms.

The fee for the most recent experience study appears to be $89,571 (April 3, 2012 invoice). If this is an accurate assessment of GRS’ fees they are much higher than most fees we see for an experience study for a group of this size. Typically experience study fees are in the range of $45,000 to $50,000.