Accumulated Sick Leave Conversion Credit Programs

Actuarial Audit of December 31, 2018 Valuation

Prepared by:

Timothy Herman, FSA, EA, MAAA
Principal and Consulting Actuary

Milliman, Inc.
15800 Bluemound Road, Suite 100
Brookfield, WI 53005-6043
Tel +1 262 923 3687
milliman.com

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15800 Bluemound Road
Suite 100
Brookfield, WI 53005-6043
USA

Tel +1 262 784 2250
Fax +1 262 923 3687

milliman.com

August 23, 2019

Ms. Cindy Klimke, CPA
Chief Trust Finance Officer
State of Wisconsin
Department of Employee Trust Funds
4822 Madison Yards Way
Madison, Wisconsin 53705

Re: Accumulated Sick Leave Conversion Credit Programs
Actuarial Audit of December 31, 2018 Valuation

Dear Cindy:

The enclosed report presents the findings from our audit of the December 31, 2018 actuarial valuation report dated May 31, 2019 that was prepared by GRS Retirement Consulting (GRS) for the Accumulated Sick Leave Conversion Credit (ASLCC) Programs. An overview of our major findings is included in the Executive Summary section of the report. More detailed commentary on our review process is included in the latter sections.

All calculations are based on the ASLCC Program's plan provisions and the actuarial assumptions adopted by the Employee Trust Fund (ETF) Board. The plan provisions, assumptions and methods used are the same as those disclosed in GRS's December 31, 2018 valuation report. As discussed in our report, we believe the package of actuarial assumptions and methods is reasonable (taking into account the experience of ASLCC and reasonable expectations). Nevertheless, the emerging costs will vary from those presented in this report to the extent that actual experience differs from that projected by the actuarial assumptions. Future actuarial measurements may differ significantly from the current measurements presented in this report due to factors such as the following:

- Plan experience differing from the actuarial assumptions,
- Future changes in the actuarial assumptions,
- Increases or decreases expected as part of the natural operation of the methodology used for these measurements (such as potential additional contribution requirements due to changes in the Plan's funded status), and
- Changes in the plan provisions or accounting standards.

Due to the scope of this assignment, we did not perform an analysis of the potential range of such measurements.

In preparing this report, we relied, without audit, on information (some oral and some in writing) supplied by the Department of Employee Trust Funds staff (DETF). This information includes, but is not limited to, statutory provisions, employee data, and financial information. In our examination of these data, we have found them to be reasonably consistent and comparable with data used for other purposes. Since the audit results are dependent on the integrity of the data supplied, the results can be expected to differ if the underlying data is incomplete or

missing. It should be noted that if any data or other information is inaccurate or incomplete, our calculations may need to be revised.

On the basis of the foregoing, we hereby certify that, to the best of our knowledge and belief, this report is complete and accurate and has been prepared in accordance with generally recognized and accepted actuarial principles and practices which are consistent with the Actuarial Standards of Practice promulgated by the Actuarial Standards Board and the applicable Code of Professional Conduct, amplifying Opinions, and supporting Recommendations of the American Academy of Actuaries.

Milliman's work product was prepared exclusively for DETF for a specific and limited purpose. It is a complex, technical analysis that assumes a high level of knowledge concerning DETF's operations, and uses DETF's data, which Milliman has not audited. It is not for the use or benefit of any third party for any purpose. Any third party recipient of Milliman's work product who desires professional guidance should not rely upon Milliman's work product, but should engage qualified professionals for advice appropriate to its own specific needs.

The consultant who worked on this assignment is a retirement actuary. Milliman's advice is not intended to be a substitute for qualified legal or accounting counsel.

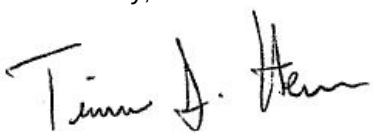
The signing actuary is independent of the plan sponsors. We are not aware of any relationship that would impair the objectivity of our work.

We would like to express our appreciation to both the GRS and DETF staff for their assistance in supplying the data and information on which this report is based.

I am a member of the American Academy of Actuaries and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein.

I respectfully submit the following report, and look forward to discussing it with you.

Sincerely,



Timothy J. Herman, FSA, EA, MAAA
Principal and Consulting Actuary

TJH/cmw

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Section 1 Summary of the Findings

Purpose and Scope of the Actuarial Audit

In this actuarial audit, we independently calculate the key results from the December 31, 2018 actuarial valuation and review the actuarial assumptions used in the valuation. The purpose of this audit is to provide an opinion regarding the reasonableness and accuracy of the actuarial assumptions, actuarial cost methods, valuation results and contribution rates. The following tasks were performed in this audit:

- ✓ Evaluation of the data used in the valuation,
- ✓ Full independent replication of the key valuation results,
- ✓ Confirmation that the actuarial assumptions are reasonable and appropriate, and
- ✓ Analysis of valuation results and reconciliation of material differences (if any).

Audit Conclusion

Actuarial Valuation

Based upon our review of the December 31, 2018 actuarial valuation, we found the valuation results were reasonable. The following table shows that our independent calculations are close to those determined by GRS based on the methods and assumptions used in the valuation. Given the myriad of calculations and differences in actuarial software between firms, we would not expect to match GRS's calculations exactly; however, the overall results indicate a high level of consistency.

Further analysis is shown in the appendices.

	GRS	Milliman
Recommended Contribution Rate		
Base Rate	0.9%	0.8%
Supplemental Rate	0.3%	0.4%
Total	1.2%	1.2%
Funded Ratio (Entry Age Normal)		
Base Plan	107.9%	107.9%
Supplemental Plan	109.1%	105.7%

Membership Data

We performed tests on the raw data supplied by DETF staff. Based on this review, we feel the individual member data used is appropriate and complete. A summary is shown in the table on the following page:

	GRS	Milliman	Ratio GRS/Milliman
Active Members			
Count	71,670	72,799	98.4%
Average Age in years	45.0	44.9	100.2%
Average Service in years	10.8	10.8	100.0%
Average Sick Leave Days	80.0	78.9	101.4%
Retirees			
Count, Pre-65	4,543	4,543	100.0%
Count, Post-65	12,546	12,546	100.0%
Total Retiree Count	17,089	17,089	100.0%
Monthly Premiums *($ in thousands)*			
Pre-65	5,258	5,258	100.0%
Post-65	7,850	7,850	100.0%
Total Retiree Premium	13,108	13,108	100.0%

Actuarial Value of Assets

We reviewed the method used to determine the actuarial value of assets that was used in the December 31, 2018 valuation. We found the methodology to be appropriate and in compliance with actuarial standards of practice.

Key Actuarial Components

We independently calculated the Present Value of Benefits (PVB) and Present Value of Future Earnings (PVFE) of ASLCC. We found that all significant benefit provisions were accounted for in an accurate manner, the actuarial assumptions and methods were applied correctly, and our key actuarial values matched those calculated by GRS closely.

A summary of the key actuarial components is shown in the table below.

($ in thousands)	GRS	Milliman	Ratio GRS/Milliman
Present Value of Benefits			
Base Plan	$1,938	$1,923	100.8%
Supplemental Plan	$1,155	$1,193	96.8%
Present Value of Future Earnings	**$45,159**	**$48,021**	**94.0%**

Funding

We reviewed the application of the funding method and found it to be reasonable and in compliance with actuarial standards of practice. Based on the system's funding methods and assumptions, we believe the total recommended contribution rates were appropriately calculated. A comparison of the recommended contribution rate and the funded ratio using the Entry Age Normal actuarial cost method calculated by GRS and Milliman is shown in the table below. Both match within a reasonable tolerance.

	GRS	Milliman
Recommended Contribution Rate		
Base Plan	0.9%	0.8%
Supplemental Plan	0.3%	0.4%
Total	1.2%	1.2%
Funded Ratio (Entry Age Normal)		
Base Plan	107.9%	107.9%
Supplemental Plan	109.1%	105.7%

Actuarial Assumptions (Economic)

We reviewed the economic assumptions used in the valuation and found them to be reasonable. The economic assumptions used in the December 31, 2018 actuarial valuation were adopted based on GRS' Three Year Experience Study completed in November 2018.

We have the following comments regarding the economic assumptions recommended in the 2018 actuarial experience study:

- Our analysis supports the recommendation to decrease the long-term expected rate of return on assets (discount rate) from 7.2% to 7.00%, given the capital market assumptions used in GRS' analysis.
- Our analysis also supports the recommendation to decrease the price inflation assumption from 2.70% to 2.50%.
- The recommendation to decrease the real wage growth assumption from 3.20% to 3.00% is reasonable.

Actuarial Assumptions (Demographic)

We reviewed the analysis and recommendations of the demographic assumptions from GRS' Three Year Experience Study completed in November 2018. Based on this review, we believe the demographic assumptions used in the valuation are reasonable.

Reports

GRS's report meets the actuarial standards of practice that apply to pension plans. Although the ASLCC is not a pension plan, we believe that reviewing the ASLCC reports using the pension actuarial standards of practice is a reasonable approach. The report develops and presents the recommended contribution rates and adds commentary that is useful to both DETF and the Board. Actuarial Standards of Practice require an actuarial valuation report be written in a manner expected to be understood by the intended recipient and in sufficient detail to allow another actuary to form an opinion of the reasonableness of the report. The complexity of ASLCC operations require a significant amount of disclosure to allow another actuary to form such an opinion. We recommend several additions to the report (see Section 8 of this report) that would aid another actuary's review of the report.

Recommendations and Other Items to Consider in the Future

Recommended Changes

We identified no aspects of the valuation that need to be changed.

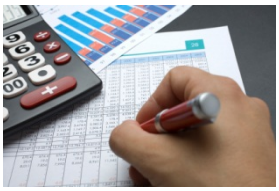
Changes to be Considered

We recommend several additions to aid another actuary's review of the report be considered for future valuation reports.

- ✓ Adding and modifying disclosures in the valuation report (See Section 8).

Section 2 Membership Data

Audit Conclusion



We performed tests on the raw data supplied by DETF staff that GRS used in the valuation. Based on this review, we feel the individual member data used is appropriate and complete.

Comments

Overall, the data process appears to be thorough and accurate. We have the following comments:

- **Raw Data**: We were provided with the same data that was given by DETF staff to GRS for use in the actuarial valuation.

  Completeness: The data did not contain all the necessary fields to perform the actuarial valuation. GRS indicated that an additional comparison of the DETF data to the WRS data was required in order to confirm eligibility and service.

  Quality: Although we did not audit the data at the source, we performed some independent checks to confirm the overall reasonableness of the data. We compared the total retiree and beneficiary premium amounts from the DETF data with the actual premiums shown in the report, as reported iin DETF's financial statements. We also compared the total active member compensation from the DETF data with the estimated active payroll for the prior year. The estimated payroll was based on the actual employer contribution amounts divided by the applicable employer contribution rates for the prior year. Based on this analysis, we found the data to be reasonable.

- **Parallel Data Processing**: We performed independent edits on the raw data and then compared our results with the summary of valuation results provided in GRS' valuation report. We found our results to be very consistent.

  Our results did not match exactly; however, this is understandable since GRS, as the retained actuary, has more extensive data editing procedures. Overall, each key data component matched within an acceptable level, and we believe the individual member data used by GRS was appropriate for valuation purposes.

  A summary of the data in aggregate is shown in Exhibit 2-1. The "Milliman" column reflects the DETF data after adjustments by Milliman. The "GRS" column reflects the census-related information contained in GRS's valuation report.

  In addition to reviewing the statistics for the plan as a whole, we also reviewed individual data and summaries by plan and groups. In our opinion, there was a very close match between the data provided by DETF and the valuation data used by GRS.

Comments
(continued)

Exhibit 2
Member Statistics as of December 31, 2018

	GRS	Milliman	Ratio GRS/Milliman
Active Members			
Count	71,670	72,799	98.4%
Average Age in years	45.0	44.9	100.2%
Average Service in years	10.8	10.8	100.0%
Average Sick Leave Days	80.0	78.9	101.4%
Retirees			
Pre-65	4,543	4,543	100.0%
Post-65	12,546	12,546	100.0%
Total Retiree Count	17,089	17,089	100.0%
Monthly Premiums *($ in thousands)*			
Pre-65	5,258	5,258	100.0%
Post-65	7,850	7,850	100.0%
Total Retiree Premium	13,108	13,108	100.0%

Section 3 Actuarial Value of Assets

Audit Conclusion

We reviewed the methodology used to calculate the actuarial value of assets that was used in the December 31, 2018 valuation. We found the methodology to be appropriate and in compliance with actuarial standards of practice.

Comments

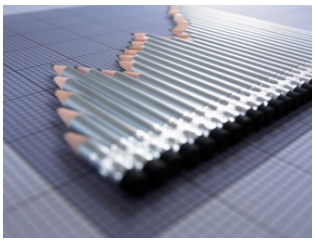
The actuarial value of assets was used in determining the plan's unfunded liability as of December 31, 2018. The amounts shown in GRS' report are the Market Recognition Account (MRA) as provided by DETF. The MRA recognizes assumed returns fully each year. Differences between the actual return and expected return are phased in over a 5-year period. DETF provided Milliman with a summary of the MRA, split between the base and supplement plans. These matched to the amounts shown in the report.

Using the MRA accounting of assets is a reasonable approach in determining the plan's unfunded actuarial liability.

In the Comments section of the report, GRS makes the observation that the actuarial value of assets exceeds the market value of assets by 5%. However, the market value of assets is not separately identified in the report. We recommend future reports include the market value of assets.

Section 4 Key Actuarial Components

Audit Conclusion



We independently calculated the key actuarial components for ASLCC's basic and supplemental program as of December 31, 2018. Under the actuarial cost method used for ASLCC, the key actuarial components are the Present Value of Benefits and the Present Value of Future Earnings. We found that all significant benefit provisions were accounted for in an accurate manner, the actuarial assumptions and methods were applied correctly, and our total present values matched those calculated by GRS closely.

Comments

We independently calculated the present value of benefits for all members and the present value of future earnings for active members based on the following:

Data: We used the same data provided to GRS in its valuation. As discussed in Section 2, we confirmed that this data was consistent with the data provided by DETF staff.

Assumptions: We used the assumptions disclosed in the December 31, 2018 actuarial valuation report. This information was provided to us electronically by GRS. We confirmed the assumptions were consistent with those adopted based on the recent experience study report.

Methods: We used the actuarial methods disclosed in the December 31, 2018 actuarial valuation report. This was supplemented by discussions between GRS and Milliman on the technical application of these methods.

Benefits: We obtained this information from the DETF website.

We then performed a full replication of GRS's valuation as of December 31, 2018, and made a detailed comparison of the Actuarial Present Value of Benefits (PVB) and Present Value of Future Earnings (PVFE) computed in our independent replication and the amounts reported by GRS.

Exhibit 4 shows a summary of this analysis, separately for current and future in-pay members. The results for each group were reasonable, and our calculated present values match closely with those reported in the valuation. The exhibit separately reports the base and supplemental plan liabilities, consistent with the GRS valuation report. To calculate the supplemental plan liabilities, GRS uses their valuation system to calculate (1) the present value of benefits for the base plan and (2) the present value of benefits for the combination of base plan and supplemental plan. Using the output from their valuation system, GRS then calculates the present value of benefits for the supplemental plan by subtracting (2) from (1). Mathematically, this is equivalent to calculating the present value of benefits for the supplemental plan directly from the valuation system. We followed the same approach to calculate the Milliman values in Exhibit 4.

Our calculated present values were close to GRS's in total. A summary of the key actuarial components is shown in the following table:

Exhibit 4
Key Actuarial Components
(Dollar Amounts in Millions)

Actuarial Component	GRS	Milliman	Ratio GRS/Milliman
Present Value of Benefits			
(1) Base Plan			
Current Retirees and Beneficiaries	$471	$472	99.8%
Active Members	$1,467	$1,451	101.1%
Total Base Plan PVB	$1,938	$1,923	100.8%
(2) Base plus Supplemental Plan			
Current Retirees and Beneficiaries	$962	$966	99.6%
Active Members	$2,131	$2,150	99.1%
Total Base plus Supplemental Plan PVB	$3,093	$3,116	99.3%
(3) Supplemental Plan [(2) - (1)]			
Current Retirees and Beneficiaries	$491	$494	99.4%
Active Members	$664	$699	95.0%
Total Supplemental Plan PVB	$1,155	$1,193	96.8%
Present Value of Future Earnings	$45,159	$48,021	94.0%

There will always be differences in the calculated liabilities when different software is used by different actuaries; however, the results should not deviate significantly. The ratios of the present value of benefits for base plan and the combination of base plus supplemental plan match closely for current retirees and beneficiaries, active members and in total. With the exception of the 95.0% ratio for active members, the ratios for the supplemental plan also match closely. We are comfortable with this result due to the leverage that exists in the way the supplemental plan works. When a member retires, the accumulated sick leave conversion balance for the base plan is used to pay for health insurance premiums. After the balance for the base plan is exhausted, then the balance for the supplemental plan is used.

Our audit provides a high level of assurance that the results of the valuation reasonably reflect the aggregate liabilities of ASLCC based on the assumptions and methods.

In addition to reviewing the liabilities in total, we also received selected results from a number of individuals included in the valuation. We were able to match closely on these individuals.

Section 5 Funding

Audit Conclusion

We reviewed the application of the funding method and found it to be reasonable and in accordance with the actuarial standards of practice that apply to pension valuations. We believe the application of pension valuation standards to the valuation of the ASLCC is appropriate. Based on the system's funding methods and assumptions, we believe the recommended contribution rates were appropriately calculated.

Comments

Contribution Adequacy

The Conference of Consulting Actuaries Public Plans Community (CCA PPC) published a paper on model actuarial funding policies which includes guidance for pension funding. Although the ASLCC program is not a pension plan, we believe that applying pension funding principles to the ASLCC program is a reasonable approach. The method of funding the ASLCC's UAAL over a closed 23-year period falls in the "Model Practices" category as defined by the CCA PPC white paper,

There will always be a competition between providing strong funding to the plan and having reasonable contribution rates for the employer. We believe that the funding method strikes a reasonable balance between the two.

Actuarial Cost Method

The purpose of any cost method is to allocate the cost of future benefits to specific time periods. Most public plans follow one of a group of generally accepted funding methods, which allocate the cost over the members' working years. In this way, benefits are financed during the time in which services are provided. ASLCC uses the Frozen Initial Liability actuarial cost method. We agree that it is appropriate for valuing the costs and liabilities of ASLCC.

The Frozen Initial Liability Actuarial Cost Method with separate normal cost rates calculated for the Base and Supplemental Plans falls in the "Acceptable Practice" category as defined by the CCA PPC white paper so long as the valuation report also discloses the Actuarial Accrued Liability calculated under the Entry Age Normal actuarial cost method. The GRS report discloses the Entry Age Normal actuarial accrued liability and funded ratio.

Section 6 Actuarial Assumptions (Economic)

Audit Conclusion

Comments

The purpose of the actuarial valuation is to analyze the resources needed to meet the current and future obligations of the System. To provide the best estimate of the long-term funded status of the System, the actuarial valuation should be predicated on methods and assumptions that will estimate the future obligations of the System in a reasonable manner.

An actuarial valuation uses various methods and two different types of assumptions: economic and demographic. Economic assumptions are related to the general economy and its long-term impact on the System, or to the operation of the System itself. Demographic assumptions are based on the emergence of the specific experience of the System's members. This section of the report will focus on the economic assumptions. The following section will address the demographic assumptions.

We reviewed the economic assumptions used in the valuation and found them to be reasonable. The economic assumptions used were adopted based on GRS's Actuarial Experience Study completed in November 2018.

We have the following comments regarding the economic assumptions in the 2018 experience study:

- Our analysis supports the recommendation to decrease the long-term expected rate of return on assets (discount rate) from 7.2% to 7.0%, given ASLCC's assumptions for inflation and the capital market assumptions used in GRS's analysis.
- Our analysis also supports the recommendation to decrease the price inflation assumption from 2.7% to 2.5%.
- The recommendation to reduce the wage inflation rate of 3.2% to 3.0% is reasonable.
- The overall package of economic assumptions is reasonable.

Actuarial Standard of Practice No. 27: Selection of Economic Assumptions

Actuarial Standard of Practice (ASOP) No. 27, *Selection of Economic Assumptions for Measuring Pension Obligations*, provides guidance to actuaries giving advice on selecting economic assumptions for measuring obligations under defined benefit plans. While ASOP 27 does not directly apply to the ASLCC because the ASLCC is not a pension plan, we believe ASOP 27 provides a reasonable framework for the evaluation of the assumptions used in the actuarial valuation of the ASLCC.

As the future is unknown, the best an actuary can do is to use professional judgment to estimate possible future economic outcomes. These estimates are based on a mixture of past experience, future expectations, and professional judgment. The actuary should consider a number of factors, including the purpose and nature of the measurement, and appropriate recent and long-term historical economic data. ASOP 27 explicitly advises the actuary not to give undue weight to recent experience.

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

After completing the selection process, the actuary should review the set of economic assumptions for consistency. This may entail the actuary using the same inflation component in each of the economic assumptions selected.

An actuary's estimate with respect to a particular measurement of pension obligations may change from time to time due to changing conditions or emerging plan experiences. Even if assumptions are not changed, we believe that the actuary should be satisfied that each of the economic assumptions selected for a particular measurement complies with Actuarial Standard of Practice No. 27, unless that assumption has been prescribed by someone with the authority to do so.

Economic Assumptions

Based on the information and economic environment present as of the date of GRS's analysis, we believe the economic assumptions used by GRS in the December 31, 2018 actuarial valuation are reasonable and consistent with ASOP 27. We also believe that the recommendation in the 2018 actuarial experience study to lower the inflation and investment rate of return assumptions is an appropriate recommendation.

Assumption	12/31/2017 Valuation Rate	2018 Experience Study Rate
Price Inflation	2.7%	2.5%
Real Investment Return	4.5%	4.5%
Total Investment Return	7.2%	7.0%
Price Inflation	2.7%	2.5%
Real Wage Growth	0.5%	0.5%
Total Wage Inflation Rate	3.2%	3.0%

The Board should be aware that the measured liabilities and normal cost rate are directly impacted by these important assumptions. The most critical assumption in determining the present value of benefits is the total investment return assumption.

In our opinion, the package of economic assumptions recommended in the 2018 actuarial experience study is reasonable. The following portion of this report discusses three of the key economic assumptions (inflation, wage growth, and investment rate of return).

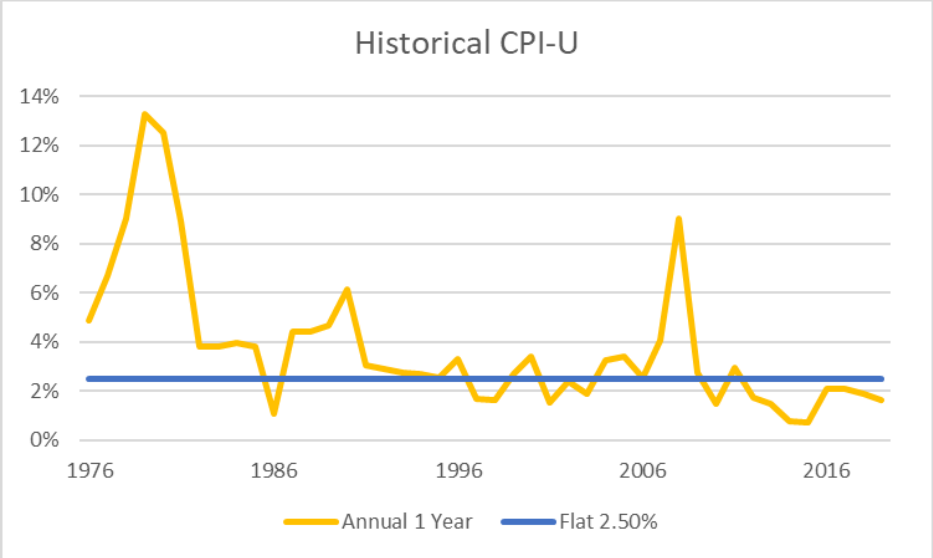
Inflation

Use in the Valuation: Inflation, as referred to here, means price inflation. The inflation assumption has an indirect impact on the results of the actuarial valuation through the development of the assumptions for investment return, general wage increases, payroll increase, and the cost-of-living adjustments for current and future retirees and survivors.

There is expected to be a long-term relationship between inflation and the investment return assumption. The basic principle is that the investors demand a "real return" – the excess of actual investment returns over inflation. If inflation rates are expected to be high, investors will demand expected investment returns that are also expected to be high enough to exceed inflation, while lower inflation rates will result in lower demanded expected investment returns, at least in the long run.

Inflation (continued)

Historical Perspective: The data for inflation shown below is based on the national Consumer Price Index, US City Average, All Urban Consumers (CPI-U) as published by the Bureau of Labor Statistics.



National and local inflation have tracked fairly closely over the long-term period.

There are numerous ways to review historical data, with significantly differing results. GRS used 15-year and 30-year moving averages for its summary of historical CPI. Using moving averages, in particular 30-year periods, gives significantly more weight to old information than it gives to recent information. For instance, it includes 30-year-old information 30 times, while only considering the past year's information for one of the 30-year periods. We believe this approach may overstate the historical data. That said, GRS's recommendation of 2.5% is reasonable. The average over the last 30 years has been 2.6%.

Forecasts of Inflation: As GRS discussed in their report, since the U.S. Treasury started issuing inflation indexed bonds (TIPS), it is possible to determine the approximate rate of inflation anticipated by the financial markets by comparing the yields on inflation indexed bonds with traditional fixed government bonds. As of July 2019, market prices suggested investors expect inflation to be about 2.05% over the next 30 years.

Although most investment consultants and economists forecast lower inflation, they are generally looking at a shorter time horizon than is appropriate for a long-term valuation like the sick leave program. To consider a longer, similar time frame, we looked at the expected increase in the CPI by the Office of the Chief Actuary for the Social Security Administration. In the 2019 Trustees Report, the projected ultimate average annual increase in the CPI under the intermediate cost assumptions was 2.6%.

Inflation (continued)

Conclusion: We believe that a 2.5% assumption is reasonable for an actuarial valuation of the ASLCC. As noted, long-term forecasts are for a somewhat lower level of inflation, so we feel that the recent recommendation to change from 2.7% to 2.5% was an appropriate recommendation. This assumption should continue to be monitored in the future.

Investment Return (Discount Rate)

Use in the Valuation: The investment return assumption is one of the primary determinants in the calculation of the expected cost of ASLCC's benefits, providing a discount of the estimated future benefit payments to reflect the time value of money. This assumption has a direct impact on the calculations of present value of benefits, present value of future earnings, and recommended contribution rates.

The discount rate is the rate used to discount future benefit payments into an actuarial present value. The traditional actuarial approach used for public sector funding sets the discount rate equal to the expected investment return. Under current standards set by the GASB, the "discount rate" should reflect the long-term expected rate of return on pension plan investments to the extent that the pension plan's assets are expected to be sufficient to pay benefits.

The recent recommendation for the net investment return assumption of 7.0% per year includes two components: (1) inflation of 2.5% and (2) a net real rate of return equal to 4.5%. This approach of splitting the net return into separate pieces is called the "building block" method.

Long-term Expected Investment Return: In the 2018 actuarial experience study, GRS used the average assumed real rates of return from a sample of investment consultants to WRS' Core Fund. That is a reasonable approach and similar to what is often used in actuarial practice. The average of the investment consultants' assumptions resulted in an average real nominal rate of return of 4.82%. After adding the 2.5% for the inflation assumption and subtracting 0.05% for administrative and investment expenses, GRS calculated an expected nominal return of 7.27%. GRS also calculated a 40% chance (confidence level) of attaining the 7.0% return on an expected value basis, which is based on arithmetic returns.

We independently reviewed the investment return using our standard model to develop expected investment return assumptions using Milliman's capital market assumptions. Milliman's investment consulting practice develops expected long-term capital market returns based on current yields and valuation levels, published surveys of expert forecasts of real GDP growth and inflation, and historical risk measures of asset class return volatility and covariance. These capital market assumptions underlie the "building block" method used in our estimate of expected return. The building block method in our model considers asset allocation, expected return and variance of each class, and correlation between asset classes. We then analyze the output ranges in order to arrive at our recommended investment return assumption.

In developing the 7.0% investment return assumption, the experience study report used the asset allocation for the Core Fund of the Wisconsin Retirement System. Our review of the investment return assumption of 7.0% for the ASLCC

reflects the 2019 Core Fund asset allocation targets as reported on the State of Wisconsin Investment Board website for the Core Fund of the Wisconsin Retirement System and Milliman's capital market assumptions as of January 1, 2019.

Asset Allocation Targets

The table below shows the asset class, the 2019 asset allocation targets and the indices used by Milliman in this analysis.

Asset Class	2019 Asset Allocation Target	Index
US Cash	-11%	BAML 30Month T-Bill
US Core Fixed Income	25%	Barclays Aggregate
US Inflation-Indexed Bonds	16%	Barclays Long Credit
Global Equity	49%	MSCI ACWI NR
Global REITs	8%	FTSE EPRO/NAREIT Developed
Private Equity	9%	Cambridge Private Equity
Hedge Funds - MultiStrategy	4%	HFRI Fund Weighted Composite

The 2019 Asset Allocation Targets for all asset classes other than US Cash are the same targets reported on the SWIB website. The sum of these targets is 111%. The SWIB website includes the footnote "Totals exceed 100% due to SWIB's overall leverage of Core Fund assets." The -11% allocation to US Cash is a proxy for the borrowing cost of the leverage strategy.

Model Output – Net Expected Investment Return

The table below shows Milliman's expected 25th, 50th and 75th percentile returns for 30, 50 and 75 year periods based on our capital market assumptions as of January 1, 2019. The percentile return refers to the likelihood that the actual return over the period will be less than the stated result. For example, we estimate that there is a 25% probability that over the next 50 years the return will be less than 5.51%. Underlying our expected investment return assumption is a 2.30% assumption for long-term average inflation.

Investment management fees and investment consulting expenses reduce the gross return available to the Plan for use in paying benefits. We applied a 5 basis point reduction to account for investment management fees in developing the table below. The 5 basis point reduction is an estimate of the level of fees associated with passive investments in the equity and fixed income asset classes (the expected returns used for alternative asset classes are net of expected fees). Actively managed investments in equity and fixed income asset classes would likely come with higher manager fees, but would not be expected to be incurred over the long run without enough positive outperformance to cover the difference.

Expected Net Investment Returns for Various Time Horizons After Reflecting Expected Investment Expenses			
	30 Year Period	50 Year Period	75 Year Period
75th Percentile Return	7.99%	7.74%	7.56%
50th Percentile Return	6.58	6.64	6.67
25th percentile return	5.18	5.56	5.79

Our analysis included an inflation assumption of 2.3%, compared to the 2.5% inflation assumption used in the GRS analysis. Factoring in this difference in underlying inflation assumptions, and based on Milliman's capital market assumptions, we believe the 7.0% investment return assumption used by GRS is reasonable.

Investment Return (Discount Rate) (continued)

Conclusion: We find the 7.0% expected return assumption is reasonable.

Section 7 Actuarial Assumptions (Demographic)

Audit Conclusion

We completed a high-level review of the valuation assumptions that were recommended in GRS's 2018 actuarial experience study. Based on this review, we believe the demographic assumptions used in the valuation are reasonable.

Comments

Studies of demographic experience involve a detailed comparison of actual and expected experience. If the actual experience differs significantly from the overall expected results, or if the actual pattern does not follow the expected pattern, new assumptions should be considered. Recommended revisions normally are not an exact representation of the experience during the observation period. Judgment is required to predict future experience from past trends and current evidence, including a determination of the amount of weight to assign to the most recent experience.

We did not independently perform the detailed calculations of the actual and expected rates that GRS did, but we reviewed the assumptions based on our experience with similar systems.

Actuarial Standard of Practice No. 35: Selection of Demographic Assumptions

Actuarial Standard of Practice No. 35 (ASOP 35) governs the selection of demographic and other noneconomic assumptions for measuring pension obligations. ASOP 35 states that the actuary should use professional judgment to estimate possible future outcomes based on past experience and future expectations, and select assumptions based upon application of that professional judgment. The actuary should select reasonable demographic assumptions in light of the particular characteristics of the defined benefit plan that is the subject of the measurement. A reasonable assumption is one that is expected to appropriately model the contingency being measured and is not anticipated to produce significant cumulative actuarial gains or losses over the measurement period.

Actual-to-Expected Ratio

In performing an experience study, an actuary will compare the actual results of the study with those the assumptions would have predicted. This comparison is called the Actual-to-Expected (A/E) ratio. If, for example, the A/E ratio for service retirement is 120%, this would indicate that the actual number of service retirements exceeded the number expected by the assumptions by 20%.

As noted, we did not independently calculate the A/E ratios, but we do comment on some of the ratios that were determined by GRS.

Post-Retirement Mortality

We reviewed GRS results for the probability of death for healthy retired members (service retirements) and found them to be reasonable.

We have the following additional comments:

- **Generational Mortality:** Based on the recent experience study, the MP-2018 mortality improvement scale was adopted and adjusted by a factor of 60%. The adjustment was related to the fact that the SOA continues to adjust their mortality improvement scale in each of the last four years, resulting in less mortality improvement than projected in the prior year's projection scale. We believe it is reasonable estimate of expected future improvements in mortality.

- **Differences by Benefit Amount:** GRS's mortality analysis partially weighs the results by benefits instead of by head count. Analysis over the years has consistently shown that retirees with above-average benefit amounts tend to live longer than those with below-average benefit amounts. This means that although a mortality table may be accurately predicting the number of deaths, it may be overstating the release of liability expected when retirees die, which is what impacts the valuation. GRS notes that the new public plan mortality tables should be available prior to the next experience study, and that they will consider these tables along with further benefit-weighted mortality at that time. We agree that further benefit-weighted mortality should be considered.

- **Mortality Tables for Active Members and Disabled Retirees:** GRS recommends making similar adjustments to the current disabled and active mortality tables as was made for the current retirees. We agree that this approach is reasonable.

Longevity and Promotion Salary Increases

We reviewed the individual salary increase assumptions due to merit (longevity and promotion). These increases are in addition to the assumed increases due to general wage inflation. For ASLCC, the general wage growth is assumed to equal their inflation assumption plus 0.5%.

We looked at the magnitude of the assumed increases. The valuation assumes smaller merit increases (in addition to general wage inflation) ranging from 0.1% to 0.7%, depending on the membership class (General, University Teachers, Public School Teachers, Protective and Executive and Elected), for members with 30 or more years of service, and higher increases ranging from 2.5% to 5.6% in the first year for members with for 30 or fewer years of service. These rates are in line with what we have seen with other systems.

In total, we believe that the assumptions for merit salary increases are reasonable and consistent with the results of the experience study.

Rates of Service Retirement

We reviewed the rates of service retirement. The current assumptions vary by membership class and age. There are also increased retirement rates on having 30 years of service for all membership classes except for the Protective class (whose rates are only based on age). Higher retirement rates for longer service members are consistent with what we have observed in other retirement

systems. We agree that these factors are significant in projecting retirement rates.

The retirement assumptions appear reasonable.

Rates of Disability Retirement

We reviewed the rates of disability retirement. The current assumptions vary by membership class and generally increase with age. Service connected and non-service connected disability assumptions were not studied separately. We believe this methodology is reasonable

The sample size is small for this assumption, but based on GRS's analysis, the disability assumptions appear reasonable.

Rates of Termination (Withdrawal)

We reviewed the rates of termination. The current assumption varies by membership class, age, and length of service. We agree that these factors are generally the most significant in projecting termination rates. Consideration was given to using differing rates for males and females for all membership classes except the Protective class.

GRS uses an assumption that no terminations take place after attaining age 60 or after eligibility for service retirement. We agree that such terminations are rare and that this is a reasonable assumption. Further, GRS assumed a certain percentage, depending on age of participants terminating after age 35 with 5 or more years of service, will leave their contributions on deposit and be paid a benefit at normal retirement age. This percentage begins at 25% at age 35 and grades down to 0% at retirement eligibility.

Based on GRS's analysis, the termination rates appear to be aligned with actual experience, and the assumptions appear reasonable.

Section 8 GRS Reports

Audit Conclusion

GRS's reports meet the actuarial standards of practice that apply to pension plans. We believe that, although the ASLCC is not a pension plan, reviewing the ASLCC reports using the pension actuarial standards of practice is a reasonable approach. The report develops and presents the recommended contribution rates and adds commentary that is useful to both DETF and the Board.

There is a new Actuarial Standard of Practice, ASOP 51, which requires that pension actuarial valuation reports must include additional information relating to risks inherent in operating and evaluating pension plans. While this standard of practice does not apply to the ASLCC, we recommend that GRS consult with DETF and determine if future reports could be enhanced by the addition of information that would be required by ASOP 51 if the ASLCC were a pension plan.

Actuarial Standards of Practice require an actuarial valuation report to be written in a manner that is expected to be understood by the intended recipient and in sufficient detail to allow another actuary to form an opinion of the reasonableness of the report. The complexity of ASLCC operations require a significant amount of disclosure to allow another actuary to form such an opinion. We recommend several additions to aid another actuary's review of the report be considered for future valuation reports.

The following discussion mentions a few items that we believe GRS should review with DETF and consider disclosing (or changing their current disclosure) in the future. These are all changes in disclosure and would not impact the results of the valuation.

Comments

Comments for Consideration for Disclosure of Funding Calculations:

- Disclose the inactive liability split between the annuitants in pay status and the annuitants in escrowed or on-hold status.
- Disclose the inactive counts used to determine the annuitant liability, which includes retirees and beneficiaries in pay status as well as inactive participants whose status is on hold or in escrow.
- Describe the data procedures to clearly disclose that the sick leave data extracts were matched to the pension valuation data in determining eligibility for the plan as well as for determining pay, sick leave hours and sick leave balances.
- Disclose that the decrements were assumed to occur mid-year and decrement relativity does not apply multiple decrement theory.
- Disclose how the pre-65 and post-65 adjusted monthly premiums are used in the report to both: (1) determine the present value of future benefits for active members and (2) use the post-65 adjusted monthly premium for their post-65 amounts for current retirees and beneficiaries under age 65.
- Disclose the methodology used to calculate the present value of benefits for the supplemental plan.