Actuarial Terms and Methodologies
A Guide in Plain English

Department of Legislative Services
Office of Policy Analysis
Annapolis, Maryland

December 2011

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Why a Primer on Actuarial Terms and Methodologies?

In recent years, State spending on employee pensions and retiree health care has become an increasingly large segment of Maryland's operating budget, and promises to continue to grow in both absolute and relative terms. **Exhibit 1** compares State payments for employee pensions and retiree health benefits for fiscal 2007 with payments for fiscal 2010.

Exhibit 1
Maryland Expenditures on Post Employment Benefits
($ in Millions)

	FY 2007	FY 2010	% Change
Pension Contributions	$726.1	$1,214.7	67.3%
Retiree Health Care	310.1	379.2	22.3%
Total	**$1,036.2**	**$1,593.9**	**53.8%**

Source: Segal Co.; Milliman, Inc.; Gabriel, Roeder, & Smith; Department of Legislative Services

As the exhibit shows, State expenditures on pension and retiree health care benefits increased by more than 50% in just three years, while the overall State budget grew by a fraction of that amount. Combined, these two line items accounted for approximately 5.0 percent of the State's total operating budget in fiscal 2010. At least four factors contributed to the recent growth in State spending on post employment benefits. First, the financial crisis of 2008/2009 eroded the pension system's assets, thereby increasing its unfunded liabilities. National demographic and economic trends, most notably the aging workforce and the rising cost of health care, represent the second factor. The teacher and employee pension enhancement enacted in 2006, designed to bring employee and teacher pensions in Maryland more in line with benefits offered in nearby states, represents a third major factor. Last, new government accounting standards are pushing local and state governments across the country to begin setting aside funds today to pay for health care costs for future state retirees.

Actuaries play a central role in determining how much the State pays annually for employee pensions and retiree health care. While any discussion of actuarial methods and terminology may serve as an effective sleep aid, a basic understanding of those methods and terms may help policymakers make decisions affecting not only employees and teachers, but the overall fiscal condition of the State.

The important role that actuarial calculations play in the State's budget process came to prominence, if not ignominy, in 2004, 2006, and again in 2008. In two of those cases, errors in actuarial calculations underestimated the amount the State owed to the pension fund by millions of dollars. In both cases, the mistakes were corrected by the following fiscal year, but the resultant underfunding in each of those years had potential long-term fiscal consequences. The third case involved the first formal actuarial calculation of the State's retiree health care liabilities, which was found to significantly overstate those liabilities. These three cases will be reviewed later in this document, but they highlight the need for policymakers to understand the process by which actuaries determine State liabilities and contribution rates so that they may be informed consumers of the results of those calculations.

But Can They Predict the Weather? – What Actuaries Do

The Society of Actuaries defines an actuary as a "professional who analyzes the financial consequences of risk. Actuaries use mathematics, statistics, and financial theory to study uncertain future events, especially those of concern to insurance and pension programs." As this definition implies, a major function of actuaries is forecasting the future and helping to figure out how to pay for it. Like any profession that engages in forecasting, actuarial science is fraught with uncertainty, but it balances that with a strong reliance on empirical evidence. Nevertheless, actuaries are more susceptible to uncertainty than other forecasters, because actuarial projections typically extend 30 or more years into the future. To ensure that actuaries are proficient in the range of knowledge and skills necessary to carry out their complex calculations, credentialing in the actuarial profession is strictly controlled. It requires years of training and practice and passage of multiple proficiency exams.

Although the actuarial profession traces its roots to the insurance industry, which still employs a majority of actuaries, it is pension and health care actuaries with which this overview is concerned. To fully appreciate their role, it is crucial to understand how the State's pension system and retiree health benefits are funded.

Paying for the Golden Years

The purpose of a pension fund is to prefund the pension benefits that have been promised to current employees. Prefunding, also called forward funding, involves setting aside sufficient funds during an employee's period of active employment to cover the full cost of pension benefits that the employee is expected to be paid upon retirement. The goal of prefunding is that retirement costs earned by this generation are not passed on to future generations because the pension fund, if properly managed, should hold sufficient assets to pay all future benefits. To the extent that pension fund inflows (*i.e.*, employee and employer contributions and investment income) fall short of the amount required to fully prefund promised benefits, the cost of those benefits is passed on. Maryland law embraces prefunding by requiring the State to pay an amount each year into the

various State pension plans "based on actuarial determination of the amounts that are required to preserve the integrity of the funds of the several systems…"

Pension benefits may be summarized by a simple equation with three variables:

Annual Payment = **Final Compensation** x **Years of Service** x **Multiplier**

In this equation, **final compensation** represents the employee's salary at the time of retirement. For most members of the Maryland State Retirement and Pension System (MSRPS), final compensation is calculated as an average of the employee's compensation from the final three years of employment; for a subset of members, final compensation is the average of the employee's compensation for the three years during which compensation was highest. **Years of service** is based on creditable service earned during employment. Although rules vary somewhat by plan, in general, one year of creditable service equals one whole year of full-time employment plus additional credit earned for unused sick leave. The benefit **multiplier** is a percentage established by statute that determines the retiree's annual payment. It represents the percentage of the employee's final compensation that he or she will be paid in annual pension payments for each year of service. Chapter 397 of 2011 lowered the benefit multipliers for State employees and public school teachers hired on or after July 1, 2011. **Exhibit 2** displays the benefit multipliers for each of the major plans within MSRPS.

Exhibit 2
Pension Plan Multipliers

Pension Plan	Hired Before July 1, 2011	Hired On or After July 1, 2011
State Employees	1.80%	1.50%
Public School Teachers	1.80%	1.50%
State Police	2.55%	No Change
Other Law Enforcement Officers	2.00%	No Change
Correctional Officers	1.82%	No Change

Source: *Annotated Code of Maryland*; State Personnel and Pensions Article

One benefit factor not reflected in the benefit formula is annual cost-of-living adjustments (COLAs) for retirees. COLAs are benefit increases designed to ensure that pension payments are not eroded by inflation. In some cases they may be automatic, but others require specific approval. For instance, COLAs for Pennsylvania retirees must be approved by the Pennsylvania legislature, which historically has granted COLAs on an irregular basis. Annual COLAs for all MSRPS retirees are automatic and based on the Consumer Price Index for all urban consumers (CPI-U). For service credit earned prior to July 1, 2011, COLA's vary by plan. COLAs for retirees of the

Employees', Teachers', and Law Enforcement Officers' Pension Systems are subject to a 3.0 percent cap. COLAs for retirees of the State Police and Correctional Officers' Retirement Systems are not capped. Retirees of the Employees' and Teachers' Retirement Systems (ERS/TRS) who opted to contribute 5.0 percent of their compensation during active service are subject to a 5.0 percent cap on their COLA; retirees of those two plans who contributed 7.0 percent of their compensation are not subject to a cap. In fiscal 2011, the change in the CPI-U was negative (-0.4%), meaning that COLAs applied to retiree benefits would have resulted in benefit reductions for State retirees. However, legislation passed during the 2010 legislative session (Chapters 56 and 57) postponed the application of the negative COLA until fiscal 2012. As a result, fiscal 2011 retirement payments to State retirees will be frozen at their fiscal 2010 levels.

Chapter 397 also changed COLA calculations for members of all plans except the Judges' Retirement System, Legislative Pension Plan, and ERS/TRS. For members of all other MSRPS plans, COLAs for service credit earned after June 30, 2011 are contingent on the fund's investment performance. In years in which the pension fund earns its target 7.75% return on its investments, the COLA is subject to a 2.5% cap. In years in which investment returns fall short of the target, the COLA is subject to a 1.0% cap.

Naturally, no one can accurately forecast exactly how much it will cost to pay pension benefits for each and every employee. Consider two employees who join a pension plan on exactly the same day. Even though they earn retirement credit in the same pension plan, the benefit formula tells us that their annual pension payments will vary based on their length of service and salary at the time of retirement. Moreover, their lifetime benefits will vary based on their lifespan, COLAs, and other factors. None of these factors can be predicted with any accuracy during their active employment. Yet, in order to prefund their retirement, the employer must begin making contributions on their behalf, beginning on the day they are hired. To help them determine an appropriate amount to contribute, employers call on a pension actuary.

Pension actuaries review the experience of the workforce covered by a particular pension plan to determine how much the employer must contribute to fulfill its obligation to each of its employees. The actuaries measure recent employees' compensation, retirement rates, lifespans, and other variables and rely on their findings to make assumptions about the group's future behavior. Although the assumptions neither reflect nor predict the actual experience of any single employee, they are expected to approximate the experience of the group over time. The actuaries also study economic and financial conditions, most notably inflation and the performance of financial markets. They factor into their calculations the cost of administering the pension plan, the benefits promised to each employee, and the value of assets already held by the pension fund before recommending a contribution rate for the employer. If their calculations are accurate, the annual employer contributions they recommend, when combined with employee contributions and investment income, should fully prefund the benefits that that group of employees is expected to earn upon retirement. The actuary's calculation of the contribution requirements is constrained by statutory mandates such as the use of the corridor method, prescribed amortization periods, and the board's approval of assumptions, particularly the investment return assumption.

Great GASB?

By contrast, Maryland, like most public employers who provide subsidized health benefits for retirees, funds those benefits on a pay-as-you-go (PAYGO) basis. As with pension benefits, active employees accrue retiree health benefits for every year they work. Instead of prefunding the cost of the retiree health benefits as their employees accrue them during their active service, most employers wait until an employee retires and then pay the insurance premium necessary to provide health coverage each year during the employee's retirement. In the case of public employers, as life expectancies rise and the cost of health care increases, future generations of taxpayers bear the increased cost of providing health coverage to prior generations of State workers.

In 2004, the Governmental Accounting Standards Board (GASB) issued new accounting standards requiring local and state governments to account for the cost of retiree health benefits in the same manner that they account for pension benefits. GASB is a nonprofit foundation that issues accounting standards for local and state governments. In recognition of the fact that governmental accounting is different than corporate accounting, GASB was formed as a counterpart to the Financial Accounting Standards Board, which performs the same function for private companies. GASB has no mechanism for enforcing the use of its accounting standards. However, the major bond rating agencies review compliance with GASB standards when issuing their bond ratings. Failure to comply with GASB standards could, therefore, affect a government's bond ratings.

The new GASB standards for single-employer plans, issued in Statement 45, require governments to account for post employment benefits other than pensions on an accrual basis rather than a PAYGO basis. As noted above, most governments fund Other Post Employment Benefits (OPEBs), like retiree health care, on a PAYGO basis. When they prepare their financial statements, they list the premium payments or claims costs (if they are self-insured) they pay on behalf of retirees as a cost, but do not list the OPEB liabilities that current employees and retirees have accrued or will continue to accrue. It is this failure to account for accrued OPEB benefits that GASB 45 addresses. In issuing Statement 45, GASB seeks to promote transparency in public accounting. Public bond markets should be aware of the looming costs of retiree health benefits that public employers have promised to current employees but failed to fund, GASB explains. It also brings OPEB accounting in line with pension accounting rules and the intergenerational equity they promote.

To comply with the requirements of GASB 45, public employers must first calculate the extent of the OPEB liability they have accrued, and for this they require the special skills of health actuaries. Like pension actuaries, health care actuaries are skilled at projecting the value of the retiree health benefits accrued by current employees and retirees. Many of the methods and terms they use in carrying out their work are similar to those of pension actuaries, although a specialized understanding of health insurance is key to the reliability of their work.

Making It Add Up

The limitation of any pension or retiree health trust fund can be summarized in one very simple equation:

Benefits + Expenses = Investment Returns + Contributions

Over time, the fund must ensure that the benefits it pays out plus the cost of administering the fund equals the contributions it takes in plus the returns it makes on its investments. Actuaries play a key role in making sure that that balance is achieved. Although they do not establish benefits, actuaries calculate how much those benefits cost. Once they establish the value of the benefits and project the fund's investment returns, they determine the employer contribution that is necessary to bring the fund into balance. The remainder of this brief explains how they carry out each of those responsibilities.

Benefit Calculations

To calculate the value of the benefits paid by the pension or OPEB fund (the first variable in the funding equation), the actuary must understand the benefits being offered and the likelihood that they will be paid. In the case of pensions, the benefit formula described earlier provides the foundation for benefit calculations, but it is not sufficient by itself. In order to calculate the value of an individual employee's future benefit, the actuary must make certain assumptions about the employee's compensation, tenure, age at retirement, life expectancy, and more. In making these assumptions, the actuary seeks answers to a range of questions, such as:

- What is the likelihood that the employee will leave the plan before vesting (and therefore not claim a benefit)?
- What is the likelihood that the employee will reach the normal retirement age?
- How long will the employee live after retirement?

In making these assumptions, the actuary relies on careful study of the behavior of current and recent employees who participate in the same pension or OPEB plan.

Experience Study: At regular intervals, actuaries conduct experience studies to assess the extent to which their assumptions reflect actual plan experience. If the assumptions consistently conflict with actual experience over a period of time, the actuary may then adjust the assumptions used in calculating the value of the benefit for future valuations. Maryland law requires the pension system's actuary to conduct an experience study at least every five years, with the most recent study completed in 2011.

Present Value of Benefits (PVB): The PVB is the total cost of benefits accrued throughout an employee's career, including benefits projected to be earned in the future, expressed

in today's dollars. Applying the range of actuarial, demographic, and financial assumptions to the benefits provided, the actuary calculates the PVB for every current employee, and then aggregates the PVBs for all employees to produce a PVB for the whole plan.

To calculate the present value of projected future benefits, public pension actuaries use a discount rate equal to the expected investment return. In Maryland's case, this is 7.75 percent. Corporate pension plans, by comparison, are required to use more conservative discount rates, based on the expected rate of return on investment-grade bonds.

Actuaries divide the PVB into two distinct components: benefits allocated to prior years of service and benefits expected to be earned in future years.

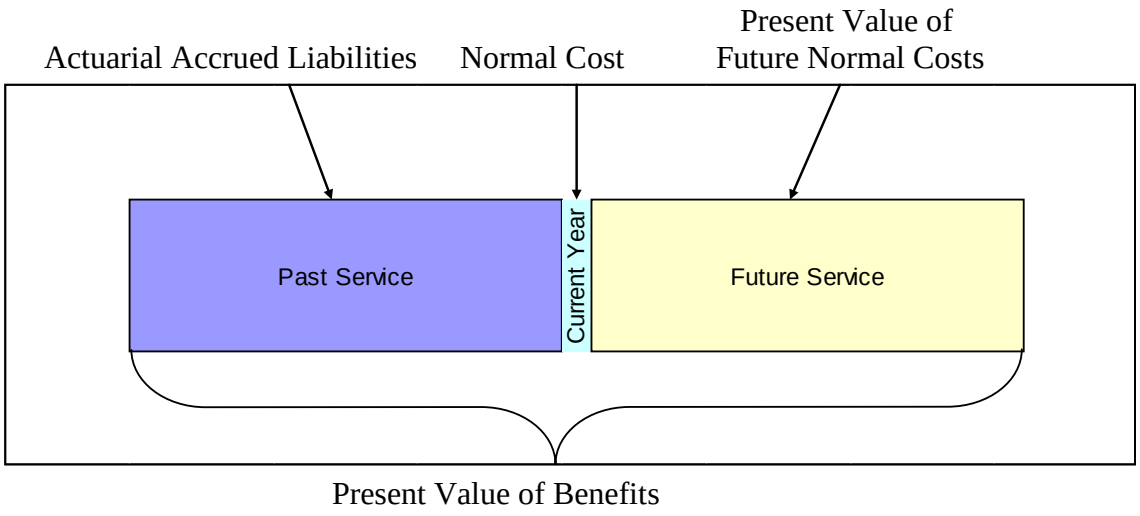
Actuarial Accrued Liability (AAL): The AAL is the portion of the PVB allocated to past service by current employees and retirees. Since retirees have already earned all of their benefits, the AAL includes the value of all benefits earned by retirees. It also includes the portion of the PVB for current employees allocated to their past service.

Normal Cost (Also Called Service Cost): The normal cost is the portion of the PVB allocated to the current year. As a result, the AAL is actually the sum of normal costs for all prior years. The present value of future normal costs is the portion of the PVB allocated to future service, including the normal cost for the current year. Only active employees contribute to the normal cost because retirees have already accrued all of their benefits during their active service. **Exhibit 3** offers a graphical depiction of the relationship between PVB, AAL, and normal cost.

Actuarial Valuation: Each year, pension actuaries conduct actuarial valuations that calculate the PVB, AAL, and normal cost for the upcoming fiscal year. Recalculation of these amounts is necessary on an annual basis for several reasons. First, the group's demographic profile changes each year, with older members retiring and new employees being hired. Second, the pension plan's experience during the year likely did not match its assumptions. Thus, a fundamental purpose of the valuation is to calculate the size of the gap between experience and reality and its effect on the PVB, AAL, and normal cost. Actuarial gains (or losses) may be referenced in the valuation. These are simply measures of the difference between actual experience and what was expected based on actuarial assumptions. Any increase or decrease in liabilities stemming from changes in assumptions, actuarial methods, or plan benefits are not considered actuarial gains or losses, but rather increases or decreases stemming from explicit policy changes.

Actuarial Funding Method: The actuarial funding method determines how the actuary allocates the PVB to either the AAL or normal cost. Notice that the definitions of AAL and normal cost refer to the portion of the PVB allocated to the past (AAL) or future (future normal costs) rather than earned in the past or projected to be earned in the future. That is because once actuaries calculate PVBs, they do not necessarily divide it up according to when the benefit was earned. Instead, they use one of several approved methods to allocate the PVB across an employee's working life.

Exhibit 3
Components of the Present Value of Benefits



Source: Mercer

The two most common actuarial funding methods are entry age normal (EAN) and projected unit credit. EAN, which the MSRPS actuary is required to use under State law, distributes the PVB as a level percentage of the employee's pay across each year of an employee's career. Allocating the PVB based on when each portion of the total benefit was earned would shift most of the cost of the benefit to an employee's later years when their salary is likely to be higher. For government employers, which value stable expenditures from year to year, this would create additional fiscal uncertainty, especially for those with aging workforces (like Maryland). Projected unit credit by contrast, allocates the PVB based on actual and projected service. Approximately 75 percent of large public pension plans use EAN because it spreads liabilities evenly over an employee's life span.

Expense Calculations

Actuarial valuations also project pension or OPEB plan expenses for the coming year, the second variable in the funding equation. Because those expenses are usually paid out of the pension trust fund, they must be repaid so that sufficient funds are available for future benefits and plan administration. In fiscal 2011, MSRPS managed a trust fund valued at $37.5 billion (as of June 30, 2011) and administered benefits for approximately 198,000 active employees, 120,000 retirees and beneficiaries, and 52,000 vested former employees. This required a staff of 193 full-

time equivalent regular positions and a total operating budget of $30.7 million for the State Retirement Agency (SRA). Because of the effect on the pension trust fund balance, Maryland law caps total operating expenses at 0.22 percent of the salary base of all active members. The MSRPS actuary makes the allowance for both administrative and investment expenses by using a lower assumed rate of investment return than would otherwise be used.

The operating costs provided above do not reflect one major expense category for SRA: investment management fees. All trust fund assets are managed by external managers, not by SRA staff. Investment management firms charge fees for their services, typically reflected as a percentage of the value of the assets they manage. In addition, the board of trustees retains three investment consultants, one to provide general investment advice and two to provide specialized advice in the areas of private equity and real estate. Fees paid to investment managers and investment consultants are off-budget but must be accounted for by the actuary in calculating fund expenses. In fiscal 2011, MSRPS incurred $219.6 million in investment management and consulting fees.

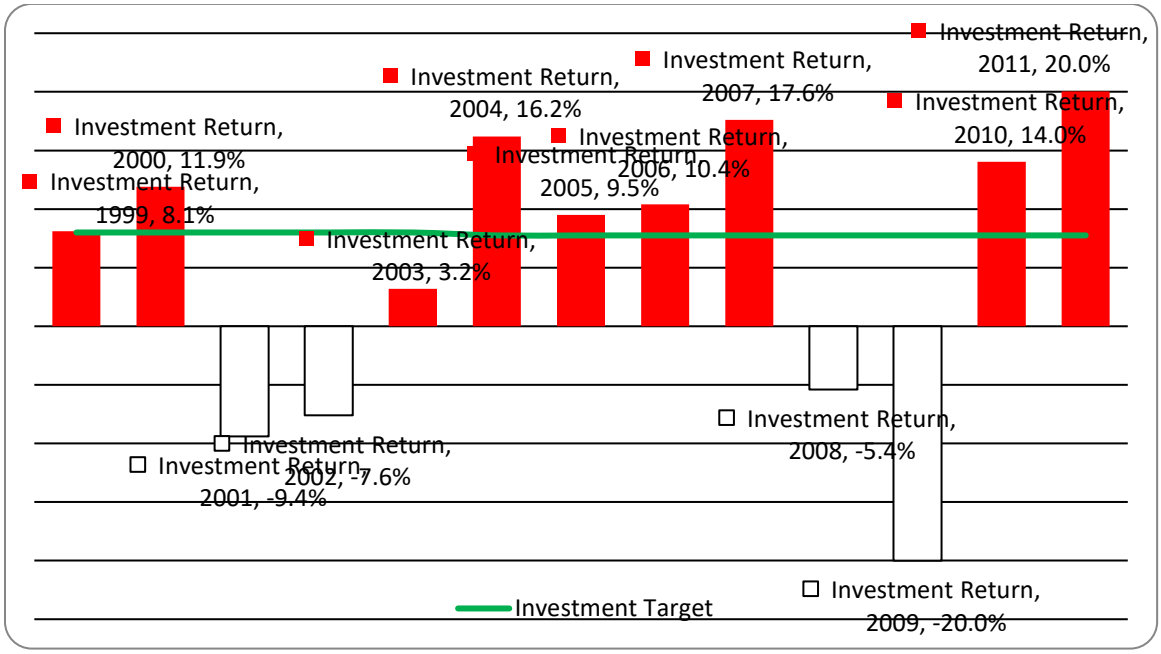
Investment Return Calculations

As the funding equation shows, investment returns represent a critical component of pension plan funding. They are the fundamental rationale behind prefunding because they minimize the amount that must be collected from employees and employers to pay for benefits. As an example, in fiscal 2011, MSRPS took in $2.0 billion in employer and employee contributions combined, but more than three times that amount ($6.3 billion) in investment income. A quick glance at the funding equation shows that investment returns are just one of two sources of assets available to a pension or OPEB fund, with the other being contributions from employees and employers. In the absence of any mitigating controls, this creates a direct and inverse relationship between the two – as investment returns go down, employer contributions go up, and vice versa. For this reason, the performance of the pension or OPEB funds' investment portfolio is of critical interest to lawmakers.

Given the central role of investment returns in the funding equation, actuaries are called upon to project the value of those returns over time in order to calculate a valid and reliable contribution rate. Rather than try to predict how a portfolio will perform in a given year, the actuary typically examines how that portfolio has performed in the past, and, given its asset allocation, uses that information to calculate an assumed annual rate of return based on long-term performance. Actuaries can also use economic techniques to adjust for changes in the market that suggest that future returns may differ from past returns. MSRPS uses 7.75 percent as its projected rate of return, which is considered a moderate to conservative estimate when compared with other public pension plans.

Exhibit 4 shows the pension plan's annual returns over the last 13 years. As the exhibit shows, the pension fund earned positive returns in 9 of the last 13 years, and it achieved or surpassed its assumed rate of return (represented by the straight line) in 8 of those years. Average annual returns for the period 2002-2011 were 5.1 percent per year.

Exhibit 4
Maryland State Retirement and Pension System Investment Returns
Fiscal 1999-2011



Source: Maryland State Retirement and Pension System

The demonstrated volatility of the system's investment performance presents a fundamental challenge to the State budget. Given the relationship between investment returns and contribution rates, the State's pension contribution rate could be subject to excessive volatility. In the interest of stabilizing annual contribution rates, actuaries employ asset smoothing methods.

Asset Smoothing: Asset smoothing is a mechanism that spreads out, or smoothes, annual investment returns over a designated period of time in order to minimize volatility. MSRPS employs a five-year rolling average to calculate its smoothed rate of return. In this way, only one-fifth of a given annual return is recognized during the year in which it occurs. In fiscal 2009, the system experienced a shortfall of $10.2 billion in investment income (which represents the 20% investment loss and the anticipated 7.75% investment return). However, only one-fifth of that amount ($2.0 billion) was initially recognized during the June 30, 2009 valuation. In addition, $389.4 million in gains from previous years was recognized, as well as $1.0 billion in losses from fiscal 2008. This highlights a key benefit of asset smoothing. Although smoothing prevents MSRPS from dramatically lowering contribution rates in any year when investment returns are high, such as in fiscal 2007 and 2011, it also protects the State from dramatic spikes in contribution rates during down years, such as 2002 or 2009.

Asset smoothing is often limited by a final adjustment to keep the AVA from being too far from the market value of assets. For MSRPS, the actuarial value is not allowed to be lower than 80.0% of market value or higher than 120.0%. Prior to 2009, this "collar" had never been invoked. However, due to the precipitous drop in the market value of assets due to the financial crisis of 2008/2009, the system ended fiscal 2009 with its AVA representing 136% of its market value of assets. This required a one-time reduction to the AVA of $4.3 billion to bring it under the 120% ceiling. As a result, instead of having $8.1 billion in investment losses from fiscal 2009 left to recognize over the remaining four years, the system has only $3.4 billion in losses from fiscal 2009 to "smooth" over the next four years.

AVA: The AVA is the market value of assets held by a pension or OPEB plan adjusted to reflect whichever asset smoothing mechanism it employs.

Funded Ratio: The ratio between a pension or OPEB plan's AVA and AAL, this is a common measure of a plan's relative financial health. Most pension plans are considered fiscally sound if their funded ratio is at least 0.8 (or 80.0%). Full funding (*i.e.*, a funded ratio of 1.0), while laudable, is not expected by most pension analysts because benefits are paid out over employees' lifetimes, so the prospect of a run on a pension fund is illogical. Fully funded plans are, therefore, rare among both private and public pension plans. Based on the most recent data available, the Public Fund Survey found that just nine states and the District of Columbia had fully funded employee or teacher pension plans. MSRPS achieved full funding in fiscal 2000; since then, its funded ratio has declined steadily. As of June 30, 2011, the system's funded ratio was 64.7%. Funded ratios below 100%, particularly ratios that decrease over time, may be considered a sign that costs are being passed to future generations.

Unfunded Actuarial Accrued Liability (UAAL): When a pension or OPEB plan's AAL exceeds its AVA, the plan has an UAAL, which is the difference between the two amounts. The UAAL is typically amortized over a specified period of time, much like a bank amortizes mortgages for home buyers. This allows pension plans to pay off their unfunded liabilities over time. GASB standards require that amortization periods not exceed 30 years, the presumed working life of the average employee. Whereas most plans use the full 30-year amortization schedule, State law requires MSRPS to amortize any new liability over 25 years.[1] Similarly, if the AVA exceeds the AAL, the resulting surplus is recognized over a period of time, typically much shorter than 30 years.

Contribution Calculations

Contributions to the pension fund traditionally come from two sources: employees and employers.

[1] Liabilities as of 2000 were amortized over 20 years from that date.

Employee Contributions: The employee contribution rate is the amount that members must contribute to the pension fund as a condition of their participation in the pension plan. It is typically expressed as a percentage of members' annual compensation. A small number of public defined benefit pension plans are noncontributory, so employees in those plans contribute nothing toward their pension. Maryland's Employees' and Teachers' Pension Systems were both noncontributory until 1998, and a handful of participating local governments remain in the noncontributory portions.

Employee contribution rates are established in statute so, barring legislative action, they are constant from year to year. The amount of funding employee contributions generate for the pension fund on an annual basis varies with payroll. **Exhibit 5** provides the employee contribution rates for each of the major MSRPS plans.

Exhibit 5
Employee Contribution Rates

Pension Plan	Contribution Rate
State Employees	7.0%
Public School Teachers	7.0%
State Police	8.0%
Other Law Enforcement Officers	6.0%
Correctional Officers	5.0%

Source: *Annotated Code of Maryland*; State Personnel and Pensions Article

In the case of OPEB funds, retiree contributions include any portion of premium costs not covered by an employer premium subsidy, as well as any out-of-pocket costs, such as deductibles and co-payments.

Annual Required (Employer) Contribution: The Annual Required Contribution (ARC) is a GASB term that represents the amount that an employer must report as its annual obligation to the pension or OPEB fund. The ARC, expressed either as a dollar amount or a percentage of payroll, has two components: the annual normal cost and the annual amortization payment of the UAAL. If the fund has a surplus instead of unfunded liabilities, then the surplus is amortized and subtracted from the normal cost to arrive at the ARC.

Corridor Funding Method: The corridor funding method was enacted in 2002 as a means of controlling the growth and volatility of the State's pension contribution, even beyond the control exerted by asset smoothing. As Exhibit 4 shows, MSRPS experienced dramatic investment losses in fiscal 2001 in the wake of the September 11 attacks and technology stocks tumbling in value. Even with asset smoothing, those losses, combined with subsequent losses in fiscal 2002, increased the ARC beyond the State's apparent ability to pay.

The corridor method froze the contribution rates for the Employees' and Teachers' Pension and Retirement Systems at fiscal 2002 levels, as long as the systems have funded ratios between 90 and 110 percent, inclusive. When the funded ratios fall outside this corridor, the statute requires that the contribution increase by just 20 percent of the difference between the prior year's contribution rate and the true rate required to fully fund the system over a 25-year amortization schedule. At the time the corridor method was adopted, both systems were within the corridor. The employees' plan dropped out of the corridor in 2005 and the teachers' plan followed in 2006. Since its enactment, the corridor has generated annual savings of between $100 million and $500 million in the State's employer contributions. At the same time, it has contributed to the declining funded ratio for MSRPS because it creates deliberate short-term underfunding of the system's liabilities. In the long-term, actuarial analyses have shown that the corridor will return the State to full funding within 30 years, just as full funding would have done. The catch is that employer contributions under the corridor method will begin to exceed the true rate within the next 5 to 10 years to make up for years of underfunding.

Net OPEB Obligation (NOO): Although GASB 45 requires state and local governments to recognize their OPEB liabilities on their balance sheets for the first time, it does not require that they recognize the full amount of their unfunded liability. Instead, it only requires that they recognize the NOO, which is defined as the cumulative difference between ARCs and an employer's actual annual payments, plus accrued interest. Therefore, if a public employer pays the full ARC every year from the time that GASB 45 takes effect, it would not have an NOO to report on its balance sheet. For every year that an employer does not pay the full ARC, the difference between the ARC and the actual payment into an OPEB trust fund is added to the NOO, where it accrues interest. As of June 30, 2011, the State's NOO was $3.2 billion.

Recent Actuarial Issues in Maryland

2004 State Police Valuation

During the 2004 actuarial valuation by the State's then-actuary, it was discovered that for an unknown number of years, a segment of participants in the State Police Retirement System had been improperly coded in the actuarial database. The problem hinged on the classification of benefits as either single-life annuities or joint-and-survivor annuities. A single-life annuity provides a fixed benefit payment to the retired member; when the member dies, all payments stop and the surviving spouse receives no further benefit. A joint-and-survivor annuity provides a fixed benefit payment to the retired member, but when the member dies, payments continue for the surviving spouse in some form.

Under most pension plans, members choose between a single life annuity and a lower, actuarially equivalent joint-and-survivor annuity at the time of their retirement. In order to make the two types of benefits actuarially equivalent, the fixed payment provided to the member under a joint-and-survivor is reduced to reflect the fact that payments will continue after he or she dies.

However, the State Police plan automatically provides an unreduced joint-and-survivor benefit for married State Police retirees, with surviving spouses receiving one-half of the benefit payment upon the member's death. During the 2004 valuation, the actuary found that benefits for State Police employees were being computed on a single-life annuity basis. Since those members were entitled to an unreduced joint-and-survivor benefit upon retirement, the benefit to which they were entitled was worth more than was reflected in the actuary's calculations (*i.e.*, the PVB and AAL were both undercounted).

By lowering the size of the State Police's AAL, this error had led the actuary to calculate that the fund was substantially overfunded, with an actuarial surplus of $222.8 million. Given the surplus, the actuary then compounded the problem by recommending that the State make no employer contribution for the State Police plan in fiscal 2005. Unfortunately, when the error was discovered, it was too late to reverse this contribution holiday. A corrected valuation shrank the surplus to $87.4 million, and the fiscal 2006 ARC for the State Police plan jumped to 8.22 percent. In 2006, MSRPS hired a new actuarial consulting firm and filed a civil lawsuit against the former actuary to recover damages from the erroneous calculations. In 2011, the court awarded MSRPS $73.0 million in damages stemming from the civil suit.

2006 OPEB Valuation

In 2005, Maryland became one of the first states to conduct an actuarial valuation of its OPEB liabilities using the new accounting rules in GASB Statement 45. Because it was one of the first, the valuation's findings that the State's unfunded OPEB liabilities were approximately $20.0 billion, and its ARC $1.9 billion received widespread media exposure. The magnitude of the valuation's findings highlighted the fiscal challenges that GASB 45 was going to pose for state governments. In 2006, the newly formed Blue Ribbon Commission to Study Retiree Health Care Funding Options contracted with a different actuarial consulting firm to conduct a valuation for the 2006 plan year. That valuation found that the State's unfunded liabilities were approximately $15.0 billion with an ARC of $1.1 billion. The new valuation also garnered attention from the media and from bond rating agencies because of the vast difference between the 2005 and 2006 valuations.

Upon closer scrutiny, the reason for the very different findings was easily attributable to the assumptions used by the two actuaries. The first valuation had been conducted very hastily and without careful consideration of the assumptions to be used. As a result, several actuarial assumptions used by the State's pension actuary were applied to the OPEB valuation, often inappropriately. For instance, the first valuation assumed that 90 percent of retirees would choose medical coverage for a spouse because 90 percent of State retirees are married. However, when the new actuarial firm reviewed actual experience for the 2006 valuation, it found that only 70 percent of male retirees and 40 percent of female retirees opted for spousal health coverage. This single assumption change resulted in substantial reductions in liabilities. The first valuation had also assumed that all former State employees with a vested retiree health benefit would come back to claim their benefit when they retired, perhaps because former employees with a vested pension benefit automatically receive their benefit payments when they retire. Actual experience revealed that many former employees with a vested retiree health benefit do not claim that benefit; they

likely get retiree health coverage from a subsequent employer or through their spouse. This adjustment also served to reduce the State's OPEB liabilities.

2008 MSRPS Valuation

In the 2007 experience study, the MSRPS actuary recommended, among other things, that the system drop its use of the aggregate EAN actuarial funding method in favor of individual EAN. The actuary advised that individual EAN yielded a more precise measurement of the AAL and normal cost, whereas aggregate EAN was not accepted by the Internal Revenue Service. Although the change was subtle, it provided the foundation for a significant miscalculation of the State's pension liabilities.

In making the switch from aggregate to individual, the actuary relied on different computer software that had a programming glitch. The glitch caused it to misallocate a portion of the PVB to the AAL instead of to normal cost. As noted above, the full amount of the normal cost is included in the State contribution, but the UAAL is amortized and only a single year's payment of the full amount is included. By understating the normal cost and overstating the UAAL, the glitch reduced the normal cost portion of the State contribution and slightly increased the UAAL portion. The net result was that the certified State contribution for each State pension plan was lower than it should have been.

The error was further compounded for the two plans subject to the corridor funding method. In calculating the corridor rates, the actuary had determined that 100 percent of the cost increase due to the change in methods and assumptions should not be subject to corridor smoothing. When the original understatement of costs was corrected, the full increase was added to the corridor rates without being subject to the mitigating effects of the corridor calculation. **Exhibit 6** presents the original and corrected contributions for each of the major State pension plans. Overall, the errors understated the State's employer contribution by $87.7 million. Since the error was not corrected in time for the passage of the Governor's budget, which reflected the original contributions, the State has been making up the shortfall in subsequent years through slightly higher amortization payments.

Exhibit 6
Fiscal 2009 State Contributions

	Original		Corrected	
	Full	**Corridor**	**Full**	**Corridor**
State Employees[1]	11.45%	8.73%	12.42%	9.01%
Public School Teachers	12.18%	11.70%	13.95%	12.92%
State Police	20.53%	n/a	25.27%	n/a
Other Law Enforcement Officers	36.99%	n/a	39.90%	n/a

[1]Includes correctional officers.

Source: Segal Co.

Conclusion

It is unlikely that either of the valuation errors described above could have been uncovered by anyone other than an actuary with full access to the databases used in the valuations because the problems were embedded deep in data files and actuarial software. Yet, a member of the MSRPS board of trustees played a pivotal role in uncovering the error in the 2008 valuation when that board member began questioning some of its results. This prompted the actuary to reanalyze the data, whereupon the software glitch was uncovered. This points to the important role that policymakers can play in reviewing actuarial calculations. Important questions that should be asked include:

- What economic, demographic, and financial assumptions are being used? How well do they reflect actual experience?
- When were the assumptions last reviewed as part of an experience study? Were any changes recommended?
- Does the valuation reflect peculiarities unique to the plan being valued (such as the unreduced joint-and-survivor benefit for State Police officers)?
- To what extent are changes in the AAL and normal cost due to plan experience? To changes in actuarial methods, assumptions, or plan benefits?
- What asset smoothing methods are used? If a rolling or exponential average is used, how far back does it go? What weight is assigned to recent returns compared with older returns?
- To what extent are actuarial practices dictated by State law? Are statutory changes warranted by changing conditions?

- What, if anything, do we need to know to assess the State's intermediate and long-term obligations that is not clearly pointed out in the actuarial report and presentation?