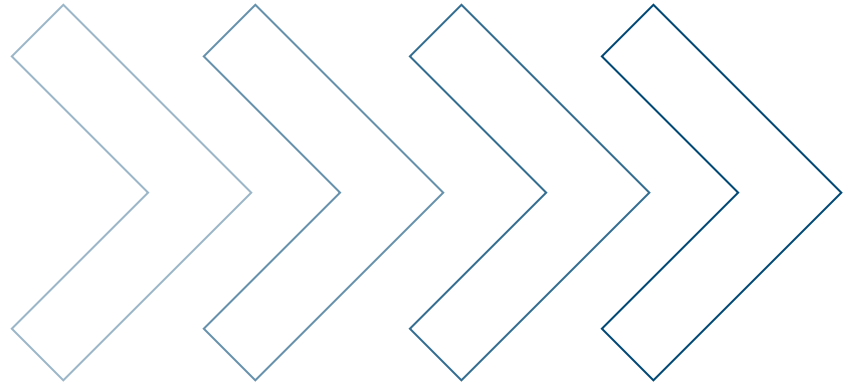




**SOCIETY OF
ACTUARIES**



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Multiemployer Plan Stress Metrics



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TABLE OF CONTENTS

ACKNOWLEDGMENTS	4
SECTION 1: EXECUTIVE SUMMARY	5
SECTION 2: INTRODUCTION AND BACKGROUND.....	6
SECTION 3: QUANTIFYING FINANCIAL STRESS	8
3.1 Uniformity for Comparability.....	8
3.2 Previous Benefit Cost	10
3.3 Previous Benefit Cost Ratio.....	10
3.4 Using the Metrics.....	11
SECTION 4: METRIC RESULTS	11
4.1 General Observations.....	13
4.2 Observations at the Median.....	13
4.3 Upper Quartile of Results	13
4.4 Lower Quartile of Results	14
4.5 Results by Industry	14
SECTION 5: FINANCIAL STRESS AND ASSET RETURNS.....	14
5.1 Risk Exposure and Volatility of Returns	14
5.2 Sensitivity to Investment Returns	16
5.3 Results by Industry	18
SECTION 6: ADMINISTRATIVE EXPENSES	18
6.1 Administrative Expense Statistics.....	18
6.2 Administrative Expenses by Industry.....	19
SECTION 7: ZONES PLUS METRICS	19
SECTION 8: SUMMARY AND FUTURE CONSIDERATIONS	20
8.1 Summary	20
8.2 Future Considerations.....	21
APPENDIX A—DATA, ASSUMPTIONS AND METHODS.....	21
A.1 Data.....	21
A.1.1 Summary of Plans	21
A.1.2 Discount Rates and Asset Allocations.....	23
A.2 Methods and Assumptions	24
A.2.1 Liabilities and Assets.....	24
A.2.2 Sensitivity Analysis	24
APPENDIX B—DETAILED RESULTS	25
B.1 Section 4: Metric Results	25
B.1.1 Graph Values and Additional Percentiles.....	25
B.1.2 By Industry	27
B.2 Section 5: Sensitivity Analysis	31
B.2.1 Graph Values and Additional Percentiles.....	31
B.2.2 By Industry Group.....	32
B.3 Section 6: Administrative Expenses.....	32
B.3.1 Graph Values and Additional Percentiles.....	32
B.3.2 By Industry	33
B.4 Section 7: Zones Plus Metrics.....	35
B.4.1 Graph Values.....	35
B.4.2 Longitudinal Values 2009–2013	36
ABOUT THE SOCIETY OF ACTUARIES	38

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Section 1: Executive Summary

Financial stress in the U.S. multiemployer defined benefit pension plan (MEPP) system is of concern to its roughly 10 million participants and 200,000 contributing employers, as well as a potential societal concern. The aggregate level of underfunding in the system is significant, no matter how one chooses to measure MEPP liabilities and assets.

On top of flat or growing unfunded liabilities, the number of active participants in the system is declining. This paper introduces two metrics for quantifying the financial stress posed by an ongoing¹ plan's unfunded liability. One assesses the burden relative to its active plan participants, and the other relative to total annualized costs of the plan.

Key observations of these metric results across the MEPP universe from 2009 to 2013 include:

- The annualized costs of previously accrued benefits make up well over half of annualized plan costs.
- The vast majority of multiemployer pension plan participants are in plans for which the annualized cost of previously accrued benefits exceeds the costs of current benefit accruals and administrative expenses combined.
- While a great number of plans are holding steady in terms of financial stress posed by unfunded liabilities, the highest stress levels are increasing over time. Only the lowest stress levels are improving appreciably.

In addition, pension plan costs are sensitive to asset returns. MEPP asset allocations commonly reflect significant investment risk. The potential reward of decreased cost if returns are high may be welcome, especially among plans that are quite stressed. However, the accompanying risk of low returns carries with it a high price that may be especially difficult for already-stressed plans to handle.

Users of these metrics may find them most helpful when monitored across time, in comparison to other plans, and in conjunction with zone status according to the Pension Protection Act of 2006.

¹ This paper studies only MEPP plans with ongoing benefit accruals. Frozen or terminated plans that no longer have active benefit accruals have been excluded.

Section 2: Introduction and Background

It is well known that the U.S. multiemployer traditional defined benefit pension plan (MEPP) system faces funding challenges. It is also well known that different industries within the system face different types of challenges. This paper explores financial stress across the system, without looking at the underlying causes of stress. Therefore, the body of the paper presents analysis for the whole system, while Appendix B provides industry-specific results.

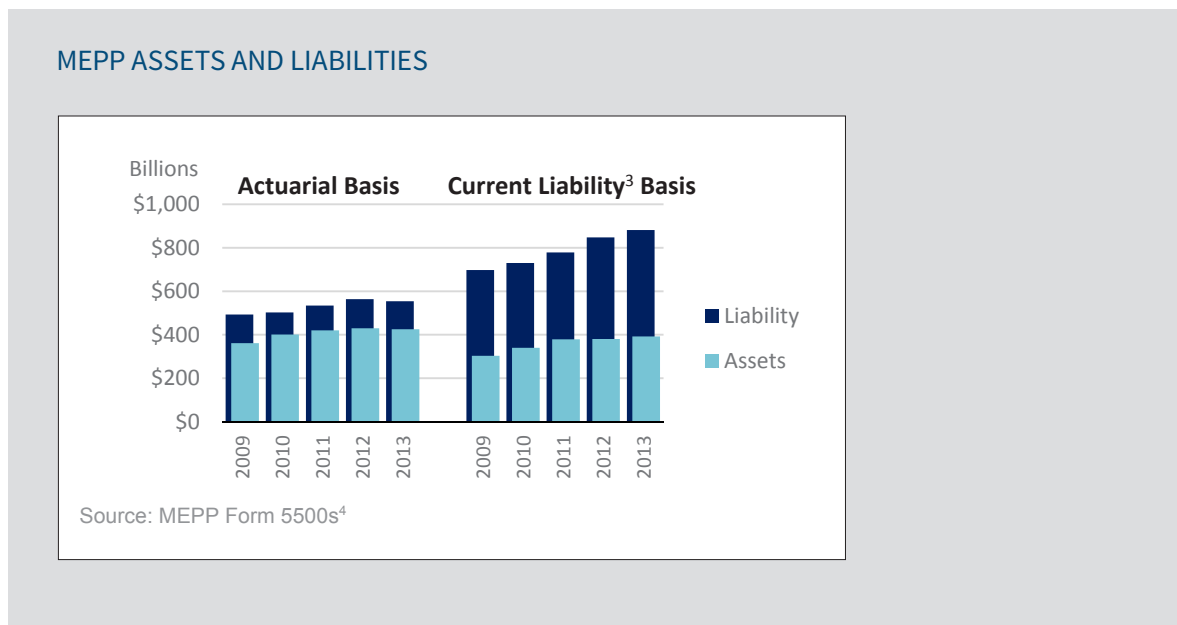
Financial stress in the MEPP system is of concern to its roughly 200,000 contributing employers and approximately 10 million participants—4 million of whom are retirees. Given the system’s size, it is also a potential societal concern.

If a multiemployer pension plan is unable to pay its benefits, the Pension Benefit Guaranty Corporation (PBGC), a government agency, provides financial assistance for paying benefits up to the guaranteed limit set by law. The monthly benefit limit depends on a number of variables, but it is at most \$35.75 per year of service.² Consequently, participants (including retirees) whose benefits exceed the limit will suffer benefit reductions.

One indicator of financial stress in pension plans is funded status. Regardless of how one chooses to measure MEPP liabilities and assets, the aggregate level of underfunding in the system is significant, as Figure 1 below shows. The numbers supporting Figure 1 may be found in Appendix A, Table 1.

Financial stress in the MEPP system is a societal concern as well as a concern for the system’s employees, retirees and employers.

Figure 1



² ERISA Section 4022A(c).

³ Current Liability for multiemployer plans is defined by the Retirement Protection Act of 1994 and reported on Form 5500 Schedule MB. It is computed using a discount rate based on an average of 30-year Treasury securities, which are typically more conservative than high-quality corporate bond rates.

⁴ Department of Labor (DOL) Form 5500 database as of June 18, 2015. For 2013, plans covering approximately 97% of the MEPP participants, assets and liabilities had been reported; figures shown for 2013 have been adjusted to estimate the complete system of plans.

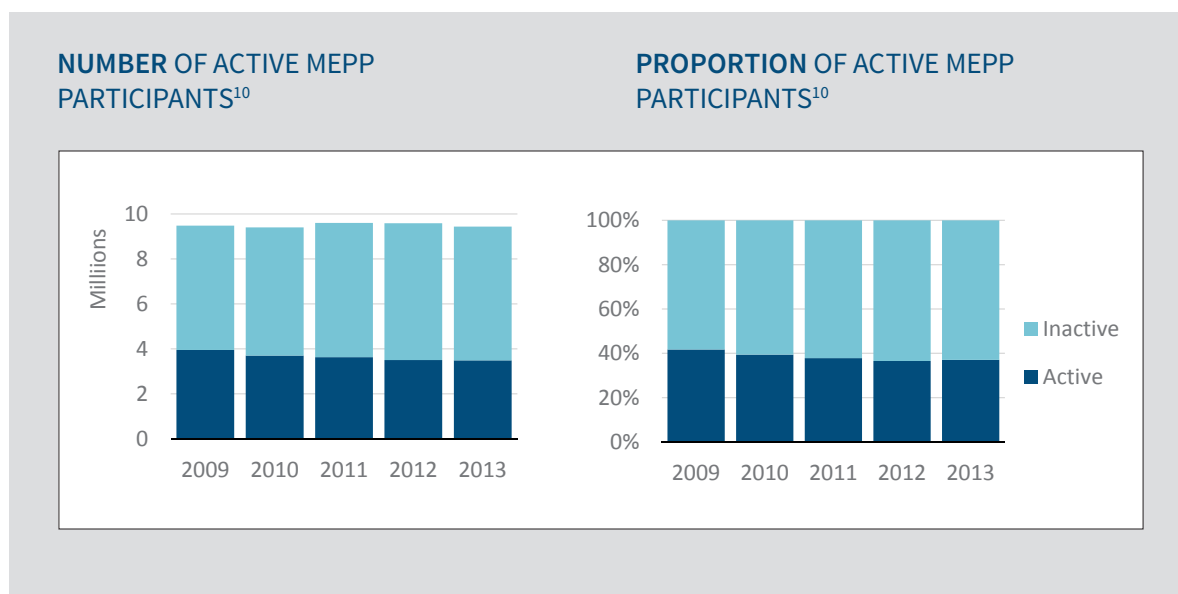
Using plan actuaries' assumptions and smoothing methods ("actuarial" basis), the system's aggregate unfunded liability in 2013 was roughly \$130 billion; in aggregate, the system was 77% funded. Measured on a Current Liability⁵ basis, which is similar to a market basis, the aggregate unfunded liability was \$490 billion, with an aggregate funding ratio of 45%.⁶

Financial stress among multiemployer plans is also a threat to the PBGC multiemployer plan program's solvency. In fact, as of Sept. 30, 2014, the PBGC reports a deficit of over \$42 billion in its multiemployer program and cites its risk of insolvency as "exceeding 50% in 2022 and reaching 90% by 2025."⁷ While changes to the law in late 2014⁸ help to address some of the issues, the PBGC continues to project significant shortfalls.⁹

An unfunded liability is a source of stress for plans because it is essentially a claim or burden on the future economic production of participating employers and workers. Compounding the weight of this burden, Figures 2 and 3 below show that the MEPP system is experiencing a declining number and proportion of active participants. Table 2 in Appendix A shows the numbers represented in the graphs.

Figure 2

Figure 3



In 2009, 42% of MEPP participants were active workers, and by 2013¹⁰ that proportion had fallen to 37%. Over the same period, 84% of plans experienced a decline in the number of actives, and the total number of actives across the entire MEPP system declined by 10%.

5 *Supra*, note 3.

6 *Supra*, note 4.

7 Pension Benefit Guaranty Corporation Annual Report Fiscal Year 2014, page 20.

8 The Multiemployer Pension Reform Act of 2014 was adopted in December 2014.

9 PBGC presentation on April 13, 2015, at Session 303 of the 2015 Enrolled Actuaries Meeting, Washington, D.C.

10 *Supra*, note 4.

Section 3: Quantifying Financial Stress

This paper introduces two metrics for quantifying the financial stress under which an ongoing¹¹ plan is operating. In addition, using Department of Labor Form 5500 data, this paper examines how the metric values have changed in recent years across the MEPP system.

The metrics focus on the burden of unfunded liabilities in the MEPP system relative to its active participants. Viewed simply, the number of active pension plan participants serves as a rough indicator of contributing employers' collective strength. An ongoing pension plan effectively depends on active participants to produce the revenues needed for their employers to fund pension plan costs.

While the number of active participants is far from sufficient to determine something as complex as the strength of contributing employers, it is a useful—albeit imperfect—barometer of financial strength. Moreover, it is readily available along with the plan's financial information on Form 5500.

These metrics represent a “snapshot” of a plan's current conditions and neither depend on nor reflect future contributions or benefit changes. However, they are influenced by actuarial assumptions, including the discount rate or assumed rate of return on assets.

Understanding the financial stress that a plan is facing includes understanding how sensitive the stress measurement is to the plan's investment returns. This paper also explores that sensitivity through these metrics.

3.1 Uniformity for Comparability

The metrics presented in this paper require actuarial calculations. Because comparing metric values is easier when they are calculated in the same way across plans, the metrics use specific methods for calculating liabilities and assets.

For these metrics, liabilities and assets are calculated using the Unit Credit cost method and market value of assets, respectively. These methods do not use actuarial smoothing techniques, which can complicate comparison across plans. Further, they are readily available because all MEPP plans report Unit Credit liabilities and normal cost on Form 5500 Schedule MB in the form of Current Liability, which uses similar mortality assumptions for all plans.

Liability calculations also require a discount rate and demographic assumptions. This paper uses demographic assumptions as reflected in the Current Liability reported on Schedule MB. The mortality table is prescribed by law, but all other demographic assumptions are selected by the plan actuary.

In a system with flat or growing unfunded liabilities and declining numbers of active participants, the economic burden borne by employers and workers to generate funding for previously accrued benefits is increasing.

Metrics are easier to compare across plans when they are calculated the same way.

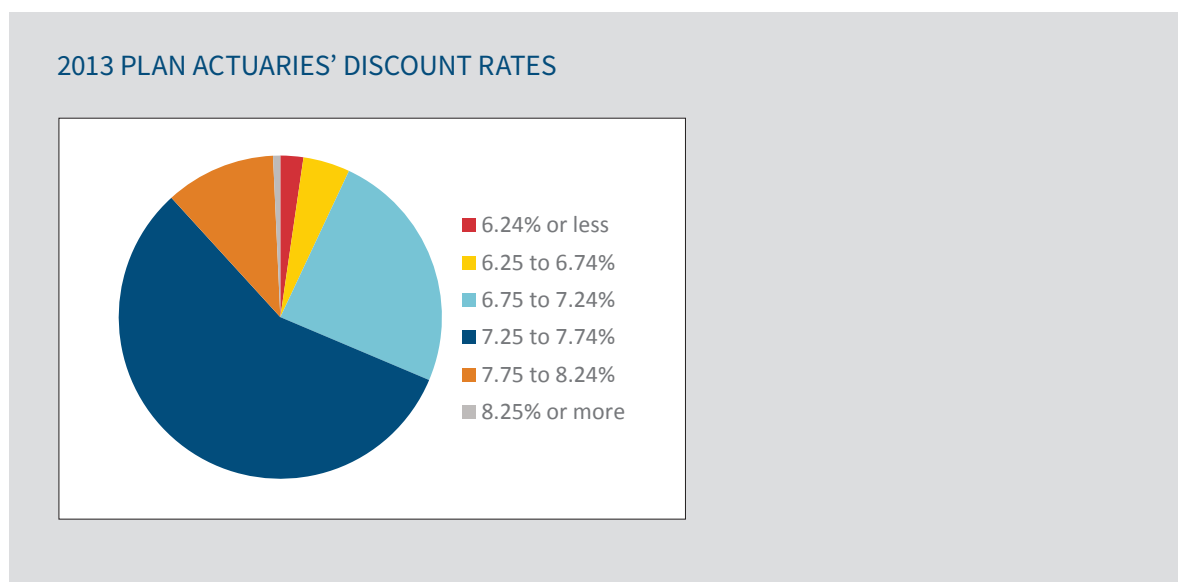
¹¹ *Supra*, note 1.

For the discount rate used in the metrics, one view is that the best discount rate for a given plan is the rate selected by the plan’s actuary.¹² On the other hand, a consistent discount rate across plans facilitates comparability, especially during sensitivity analysis. Therefore, the paper presents metrics using two different discount rates:

1. The plan actuaries’ discount rates, and
2. A uniform discount rate selected specifically for this purpose.

A variety of discount rates could be considered an appropriate uniform rate for these metrics. One choice might be the most common discount rate used by plan actuaries for funding. In 2013, 7.5% was by far the most common discount rate, followed by 7.0%, as shown in Figure 4.

Figure 4



Appendix A shows the distributions of discount rates used by MEPP actuaries for 2009 through 2013.

Alternatively, the uniform discount rate could be based on an economic analysis. Moody’s provided to the Society of Actuaries (SOA) a 15-year economic forecast that is the foundation for the discount rates selected for the sensitivity analysis presented in Section 5. Table 12 in Section 5 shows a summary of their analysis. Its median discount rate is near 7.0%. Given that 7.0% is also a common discount rate among MEPP actuaries, this paper uses a 7.0% discount rate when presenting metrics on a uniform basis.

While individual MEPP plans’ amortization periods vary depending on regulations and/or funding policy, 15 years is a common amortization period. For consistency—which aids plan comparisons—as well as simplicity, these metrics amortize a plan’s total unfunded liability (or surplus) over 15 years.¹³

The authors chose the methods and assumptions for these metrics solely because the associated liabilities are readily available by participant category, fairly consistently determined across plans and relatively simple to adjust for discount rates. The discount rate is consistent with Moody’s analysis. Neither the authors nor the SOA intends these choices as commentary on the appropriateness of funding multiemployer plans using these or any other methods or assumptions.

¹² Internal Revenue Code Section 431(c)(3) authorizes the plan actuary to determine actuarial assumptions, including the interest rate.

¹³ For this analysis, withdrawal liability payments have been disregarded; when computing the metric for a specific plan, an actuary may decide to handle withdrawal liability payments differently.

3.2 Previous Benefit Cost

One straightforward way to measure the financial burden of previous benefits on active participants is the annualized cost per current active participant to pay off a plan’s unfunded liability. This paper’s first metric, the Previous Benefit Cost (PBC), is based on this idea.

PREVIOUS BENEFIT COST (PBC)

$$\text{PBC} = \frac{\text{Unfunded Liability Amortized Over 15 Years}}{\text{Number of Active Participants}}$$

The greater the PBC, the greater is the burden on active participants of unfunded liabilities. When the PBC is zero, funding costs are associated solely with active participants’ current accruals (i.e., the plan does not have an unfunded liability).

A negative PBC indicates that the plan does not have an unfunded liability. It goes further and quantifies the level of financial freedom from unfunded liability stress, which may be useful when comparing two or more plans that have funding surplus.

The PBC is independent of plan size—whether measured by total number of participants and/or total liabilities. However, it is likely to be influenced by benefit levels, so comparing plans across industries and/or geographical areas requires a bit of caution. In many cases, neutralizing—or at least curbing—the effect of benefit levels would be helpful. An easy and obvious solution would be to compare the PBC to wages, but wage data is not reported on Form 5500. While industry average wage data are readily available from the Bureau of Labor and Statistics and may be appropriate for system-wide analysis, they may not be appropriate for plan-specific analysis.

3.3 Previous Benefit Cost Ratio

The PBC is meaningful, but given some of its shortcomings, a second, complementary metric would be helpful. The Previous Benefit Cost Ratio (PBCR) serves this purpose and quantifies the portion of a plan’s annual cost¹⁴ that is needed to pay off unfunded liabilities for previously accrued benefits.

PREVIOUS BENEFIT COST RATIO (PBCR)

$$\text{PBCR} = \frac{\text{Unfunded Liability (but not less than zero) Amortized Over 15 Years}}{\text{Normal Cost Including Expenses Plus Unfunded Liability (but not less than zero) Amortized Over 15 Years}}$$

The PBCR will range from zero to one. A PBCR of one signals that the entire annualized cost of the plan goes toward paying off the unfunded liability, while a PBCR of zero indicates that there is no unfunded liability—all of the annual costs are for

¹⁴ *Supra*, note 10.

current benefit accruals and administrative expenses. For example, a PBCR of 0.75 or 75% means that 75% of the annual cost of the plan goes toward paying off the unfunded liability, and the remaining 25% of cost is for both current benefit accruals and administrative expenses.

The PBCR does not recognize negative unfunded liability (funding surplus) because the use of funding surplus to reduce ongoing plan costs is not always a valid metric of stress and sustainability. For example, consider a plan with a funding surplus that is so large that its 15-year amortization payment (or credit) exceeds the normal cost. The PBCR's numerator and denominator would both be negative, so the PBCR would be positive. A positive PBCR is typically a sign of financial stress due to unfunded liability costs, yet in this case the plan has a funding surplus.

Furthermore, imposing a lower limit of zero on unfunded liability has the added benefit of preventing extreme mathematical results and confining outcomes to the range of zero to one.

It is important to note that when future benefit accruals are reduced, the PBCR will increase—somewhat counterintuitively, because reducing future benefit accruals is often a means of providing relief from stress due to unfunded liabilities.

3.4 Using the Metrics

For both metrics, lower values generally indicate less stress. However, considering the metrics at a single point in time provides limited context for assessing them. They are more helpful when monitored over time.

Like the PBC, the PBCR is independent of the size of a plan. The PBCR has the added benefit of essentially neutralizing or at least extensively limiting¹⁵ the influence of benefit levels. These features allow for readily comparing the PBCR across plans, industries and geographical areas.

Each of these metrics balances the potential shortcomings of the other. Using them together provides more insight than using either by itself. Stakeholders may also find it helpful to understand where a given plan's metrics stand relative to other plans, as well as to monitor trends over time.

The PBC and PBCR are most helpful when followed across time.

Please note that neither the authors nor the SOA suggests either ideal or desirable levels of these metrics.

Section 4: Metric Results

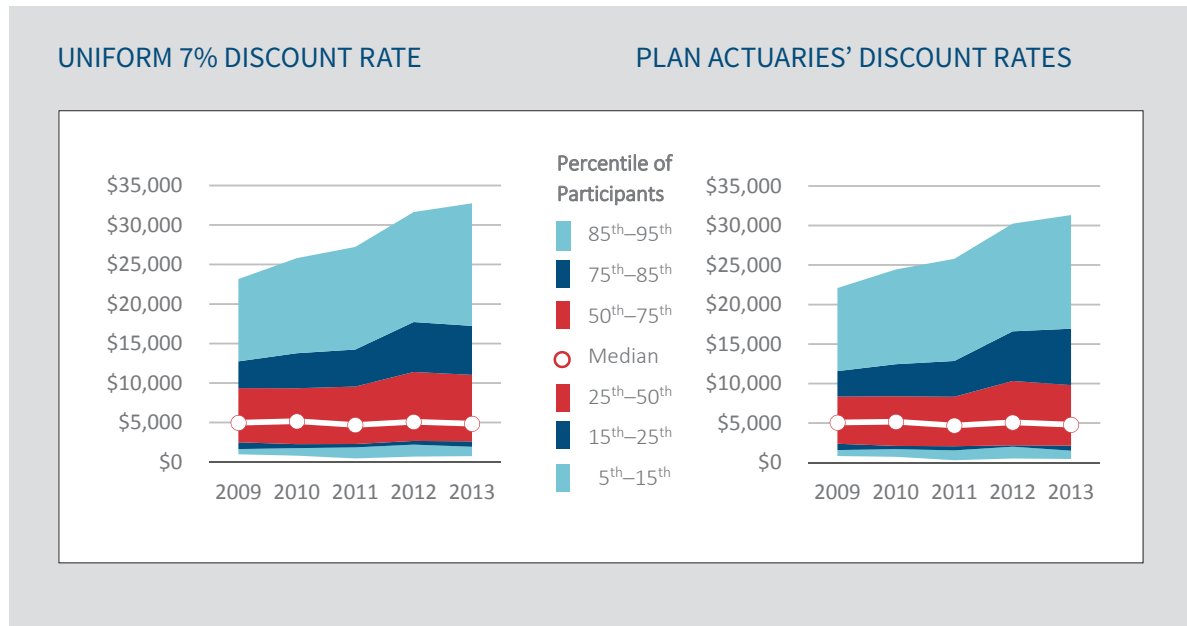
Distributions of both the PBC and PBCR are very similar on the uniform 7% basis and the basis that uses plan actuaries' discount rates (please see Figures 5 through 8 on the next page). Within each set of distributions, results are distributed separately for each year and weighted by number of plan participants. While all plans in the universe are represented, a single large plan may cover several percentiles. The data used to build these graphs may be found in Appendix B in a table whose number corresponds to the graph's figure number.

¹⁵ The pattern of historical benefit increases may influence metric results. For two plans with the same benefit level for active participants, the metric will generally be lower for the plan that experienced steeper benefit increases in the past.

Previous Benefit Cost (PBC)

Figure 5

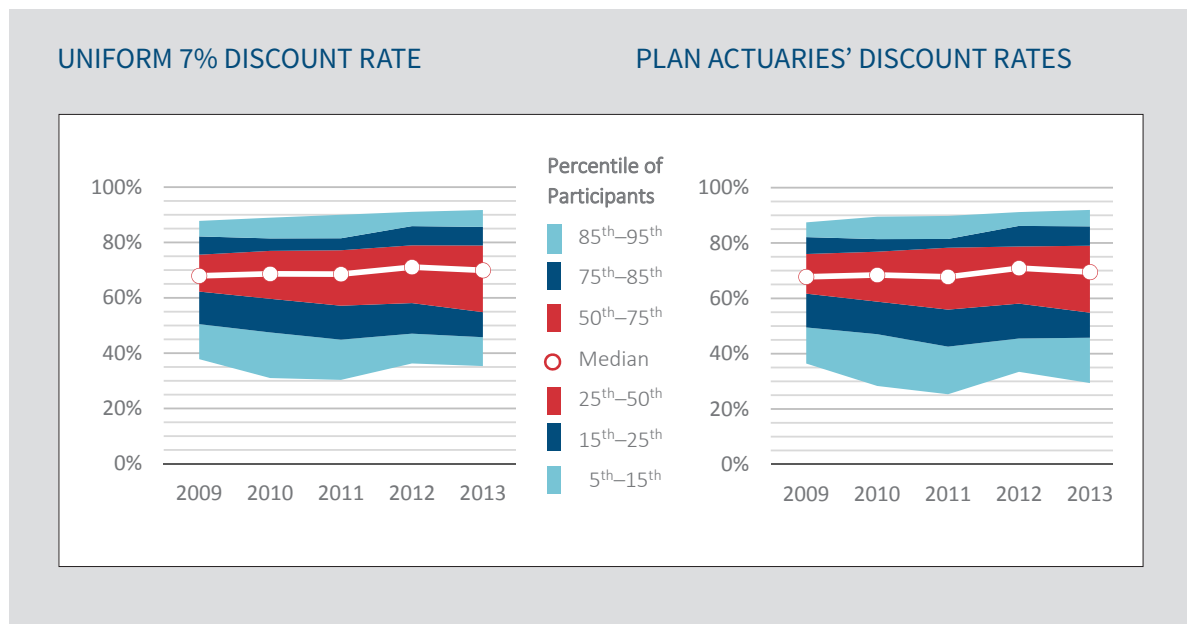
Figure 6



Previous Benefit Cost Ratio (PBCR)

Figure 7

Figure 8



4.1 General Observations

Across the MEPP system, well over half of annualized costs go toward funding previously accrued benefits. Nearly 85% of participants were in plans for which the annualized cost of previously accrued benefits exceeded the costs of current benefit accruals and administrative expenses combined.

Here are some general observations for 2009 through 2013:

- Approximately three-quarters of participants were in plans with stress levels that essentially held steady or worsened, and only about one-quarter were in plans with stress levels that improved.
- Roughly 25% of MEPP participants were in plans for which the annualized unfunded liability load was at least 3 times the combined cost of current benefit accruals and administrative expenses.
- Plans in the highest quartile of stress levels tended to experience an increase in stress over this period. Increases were most pronounced for the 85th to 95th percentiles of the distribution.
- The only significant improvements occurred among some of the plans already at low stress levels.

Observations of specific areas of the distributions for 2009 through 2013 follow.

The annualized cost of unfunded liabilities is more than the combined costs of current benefit accruals and administrative expenses for nearly 85% of MEPP participants.

4.2 Observations at the Median

From 2009 to 2013, both the PBC and PBCR values in the middle of their distributions fluctuated slightly, but essentially remained steady. More specifically:

- The median PBC value decreased slightly on both discount rate bases:
 - Approximately \$100 or 2% on the uniform 7% basis, and
 - Roughly \$300 or 6% on the plan actuaries' discount rate basis.
- The PBCR median value increased marginally on both bases (2 percentage points or nearly 3%).
- On either basis, the median annualized unfunded liability cost (PBC) is roughly \$5,000 per active participant and makes up approximately two-thirds of the plan's annual cost.

4.3 Upper Quartile of Results

Across the same time period, the upper quartile of each metric (i.e., the highest stress measurements) increased, especially in the case of the PBC. That is, plans that were already highly stressed tended to suffer an increase in stress levels.

Looking more closely at increasing stress levels among the 75th to 95th percentiles of the PBC distribution from 2009 through 2013:

- The 75th percentile increased 17% to 18% (roughly \$1,500), depending on the discount rate used.
- The 85th percentile increased by 35% on a uniform 7% basis, and by 46% using plan actuaries' discount rates.
- The 95th percentile increased 41% to 42% (approximately \$10,000), depending on the discount rate.

The most stressed plans suffered the most severe increases in stress.

With respect to changes in the PBCR across this period:

- The median PBCR ranged from 67% to 70% during this period, meaning that unfunded liabilities made up approximately two-thirds of the total annualized plan costs.
- At the same time, the upper quartile metric values generally increased slowly and steadily on both discount rate bases.

- The 75th percentile rose from 75% to 79%.
- The 85th percentile went from 82% to 86%.
- The 95th percentile grew from 88% to 92%.

Roughly 5% of participants are in plans for which annualized unfunded liability costs make up approximately 90% of annualized plan costs. For those plans, previous benefits cost 9 times as much as the combined cost of active participants' benefit accruals and administrative expenses.

Anecdotally, during this same period a number of plans reduced their future benefit accruals, which would not affect PBC results, but would increase PBCR values. The data to evaluate this issue is not readily available.

4.4 Lower Quartile of Results

Beneath the median, metric results typically held steady or improved slightly from 2009 to 2013. While some of the lowest results improved significantly in percentage terms, in nominal terms the improvements were rather modest.

In particular, PBC results on a uniform 7% basis were mixed:

- The 25th percentile values worsened slightly by \$100 from \$2,500 to \$2,600.
- The 15th percentile values worsened by a bit more—\$300 from \$1,650 to \$1,950.
- The 5th percentile (least stressed) values improved by nearly \$200 from \$980 to \$750.

However, using plan actuaries' discount rates, PBC values consistently improved over 2009 through 2013. Although some of these improvements are large percentages, all are rather modest in nominal terms:

- The 25th percentile fell by \$250 from \$2,390 to \$2,150.
- The 15th percentile improved by less than \$100 from \$1,590 to \$1,500.

The 5th percentile (least stressed) values dropped by almost \$400 from \$830 to \$460. As measured by the PBCR, metric values beneath the median consistently improved on both discount rate bases. For the lowest stress level presented (5th percentile), unfunded liability costs were approximately one-third of the total annualized cost of the plan.

For only 5% of participants, the annualized cost of unfunded liabilities made up less than a third of annualized pension costs.

4.5 Results by Industry

Different industries within the MEPP system face different issues. Appendix B shows detailed distributions by industry for each of the metrics presented above.

Section 5: Financial Stress and Asset Returns

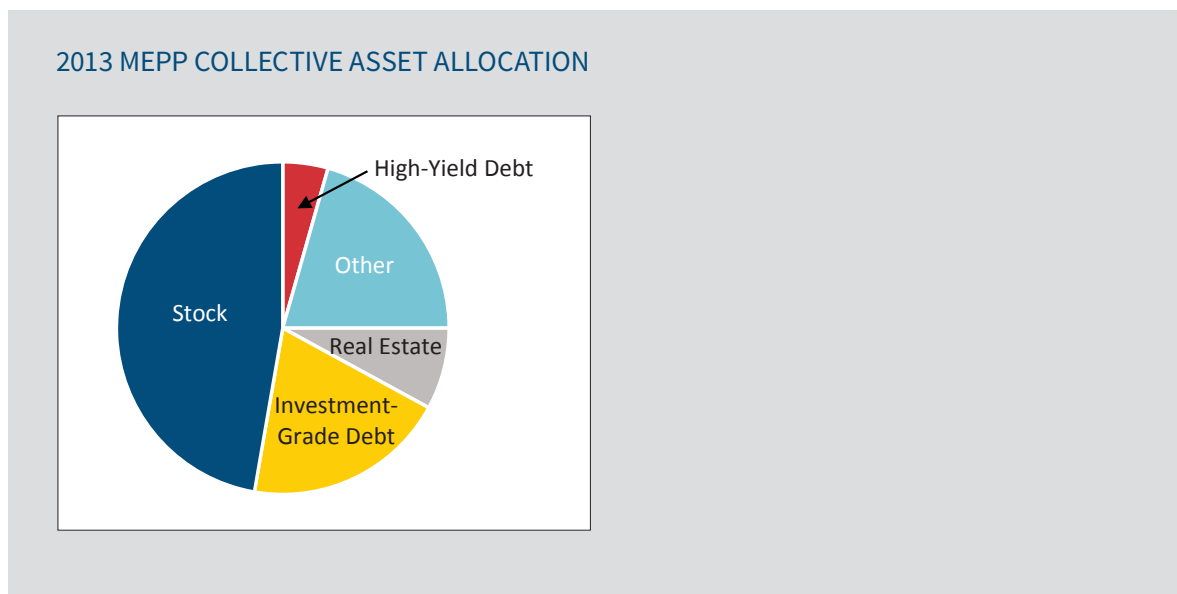
5.1 Risk Exposure and Volatility of Returns

One major factor affecting a plan's financial stress or sustainability over time is its investment earnings. Figure 9 on the next page shows collective MEPP asset allocation at the end of the 2012 plan year.¹⁶ Appendix A shows how asset allocations have changed over the period studied.

MEPP assets typically bear significant investment risk exposure.

¹⁶ *Supra*, note 4.

Figure 9



Given that collectively more than 50% of MEPP assets are in equities and high-yield debt—and possibly more assets that carry significant risk in the “other” category—the majority of MEPP participants are in plans with considerable exposure to investment risk.

A simple way to illustrate volatility in asset returns is to look at the difference in returns from year to year. The graphs below show distributions of MEPP asset returns for each plan year (Figure 10) and the differences in plans’ returns from one plan year to the next (Figure 11).

Figure 10

MEPP MARKET VALUE OF ASSET RETURNS

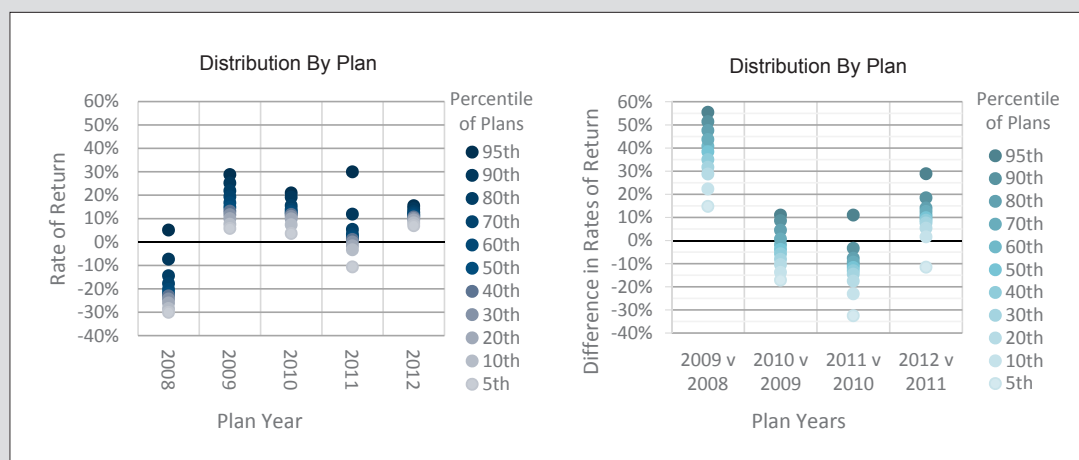
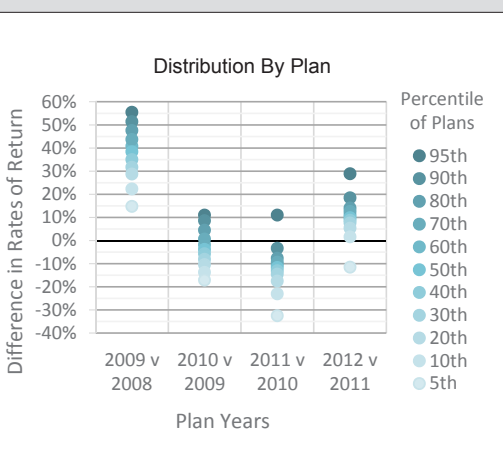


Figure 11

YEAR-TO-YEAR DIFFERENCES IN MEPP MARKET VALUE OF ASSET RETURNS



The years shown in the graphs represent the plan years for which the data was reported. For example, the 2009 Form 5500 reports asset returns for the 2008 plan year. For a plan year that began July 1, 2009, the 2009 Form 5500 shows returns for the period July 1, 2008 through June 30, 2009.

Like previously presented distributions, each year in each graph is distributed independently; one cannot draw conclusions about any given plan or set of plans by looking at these distributions.

Figures 10 and 11 show significant volatility of returns from year to year. Volatility is especially apparent in Figure 11.

5.2 Sensitivity to Investment Returns

Given the investment risk exposure among these plans, exploring the metrics' sensitivity to future asset returns adds value. For the PBC and PBCR, discount rates serve as a proxy for long-term average future asset returns. If a plan's assets earn a given rate of return over the life of the plan, the plan's cost may be represented by calculating the plan's liabilities at a discount rate equal to the rate of return.

To illustrate the effect of asset returns on PBC stress levels, a sensitivity analysis was conducted on a broad range of returns (discount rates). The specific range is based on geometric average returns from a 15-year forecast provided by Moody's to the SOA, as shown in Table 12.

Table 12

SUMMARY OF MOODY'S 15-YEAR FORECAST

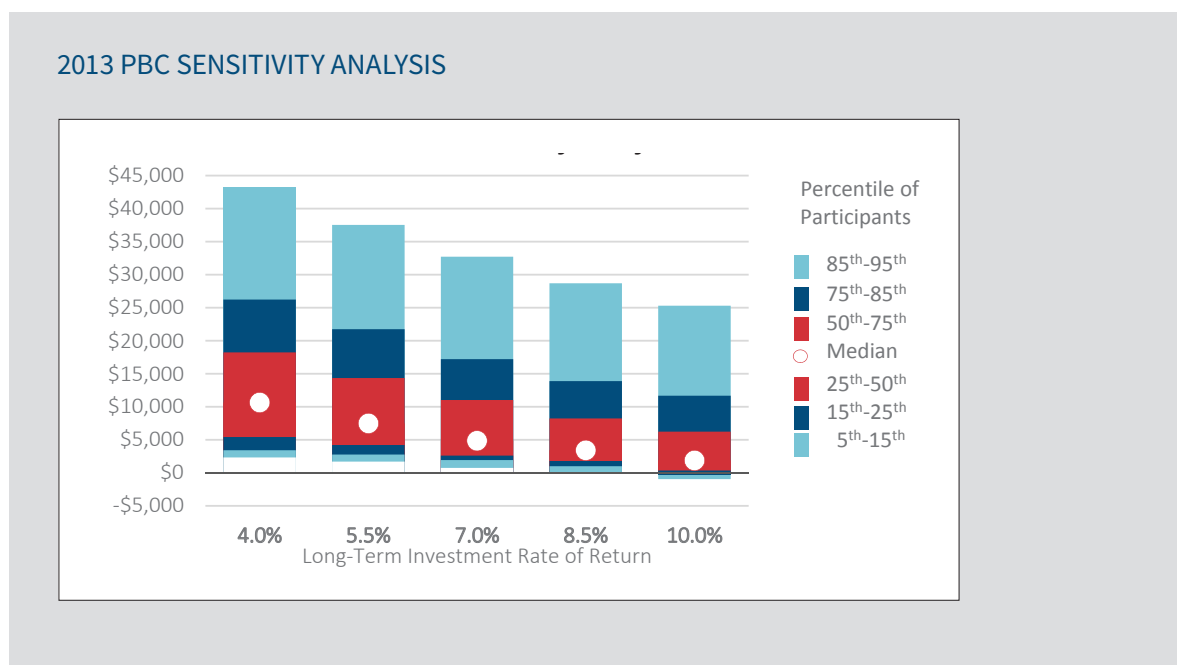
Moody's Distribution Percentile	Moody's Nominal Rate of Return	Discount Rate Used in Sensitivity Analysis	Corresponding Moody's Distribution Percentile
10 th	3.7%	4.0%	16 th
30 th	5.8%	5.5%	30 th
50 th	7.2%	7.0%	48 th
70 th	8.6%	8.5%	68 th
90 th	10.8%	10.0%	84 th

This approach to sensitivity analysis is useful for understanding the cumulative impact over time of a given asset return. However, it does not measure the short-term impact of variations in asset returns from year to year, and should not be interpreted as such.

It is important to keep in mind that a change in discount rates impacts liabilities but not assets at the time of measurement. So the impact on unfunded liabilities is amplified. A relatively small percentage change in liabilities can produce a substantial percentage change in unfunded liabilities.

The distribution of PBC results at various discount rates is shown below in Figure 13. Like previously presented distributions, results are weighted by number of plan participants and distributed separately for each rate of return. While all plans in the universe are represented, a single large plan may cover several percentiles.

Figure 13



Appendix B shows data for Figure 13 as well as data for more discount rates. In addition, Appendix B provides the distributions disaggregated by industry.

In terms of dollar amounts, the PBC is more sensitive to investment return at the higher stress measurements (higher percentiles). While it is more sensitive in terms of percentage change at lower stress measurements, the impact at higher stress values is likely of greater interest.

For example, if the annual return on assets is 8.5% instead of 7.0% (150 basis points more) PBC values noticeably improve:

- The 95th percentile decreases by 12% or \$4,000.
- The 85th percentile falls by 19% or \$3,300.
- The 75th percentile drops by 25% or \$2,800.
- The median declines by 30% or \$1,300.
- The 25th, 15th and 5th percentiles each decrease by \$800 to \$900, which translates to 32%, 48% and 111%, respectively.

The potential rewards of investment risk can carry a high price.

The impact of reducing the discount rate by 150 basis points from 7.0% to 5.5% generally mirrors the impact of increasing the discount rate by the same amount.

- The 95th percentile PBC jumps by nearly 15% or \$4,800.
- The 75th percentile PBC goes up by roughly 30% or \$3,300.
- The 25th percentile PBC rises by 60% or \$1,600, and the 5th percentile increases by \$1,000 or 130%.

A high-risk asset portfolio offers the potential reward of high returns, which could greatly alleviate stress. But it carries with it the risk of low or negative returns, which could be particularly damaging to plans that are already operating under a high level of stress.

5.3 Results by Industry

Appendix B shows sensitivity analysis by industry.

Section 6: Administrative Expenses

6.1 Administrative Expense Statistics

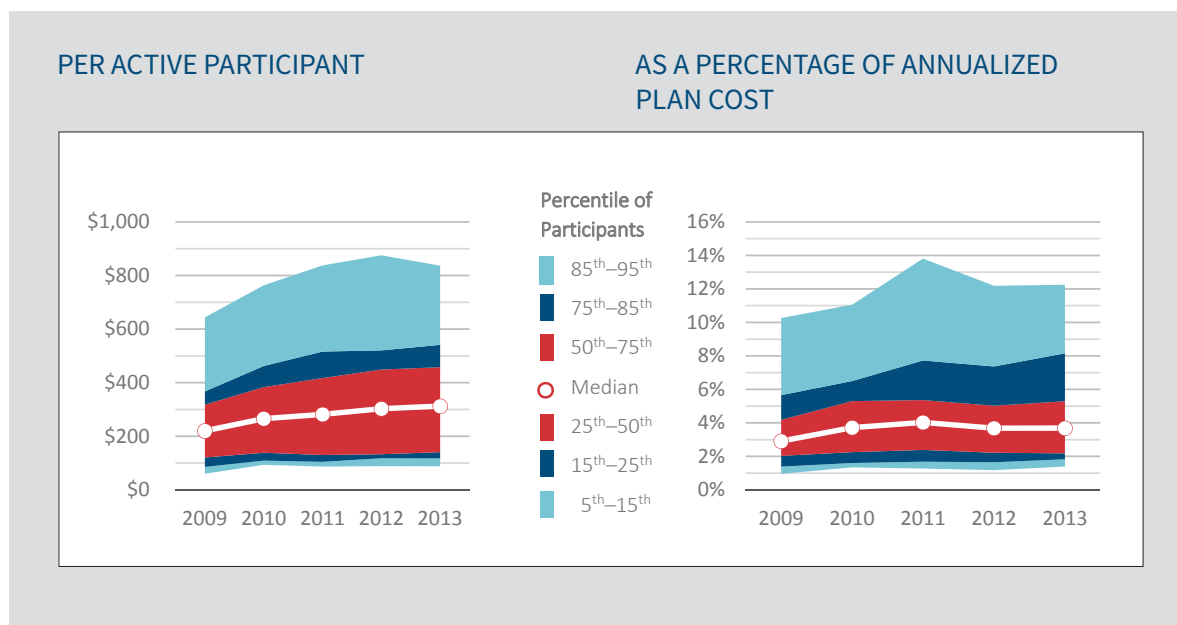
The PBCR includes administrative expenses in the annualized cost of the plan. Because they're a component of a metric introduced herein, this paper briefly looks at the estimated administrative expenses across the MEPP universe as reflected in the actuarial assumptions reported on Form 5500 Schedule MB. Exploration of any differences between assumed and actual administrative expenses is beyond the scope of this paper.

Figures 14 and 15 show estimated administrative expenses expressed in two ways: per active participant (Figure 14) and as a percentage of annualized plan cost (Figure 15), where annualized plan cost is determined in the same way as for the PBCR on the plan actuaries' discount rates basis. As with the distributions presented previously, each year in each graph is distributed separately and weighted by number of participants. While all plans in the universe are represented, a single large plan may cover several percentiles.

Estimated Administrative Expenses

Figure 14

Figure 15



As measured by these metrics, estimated administrative expenses have increased substantially over recent years. When expressed as an amount per active participant, administrative expenses in 2013 were generally 40% greater than in 2009. As a portion of total annualized plan cost, administrative expenses also increased, ranging from a 7% rise at the 25th percentile to hikes of well over 40% at the 5th and 85th percentiles.

Appendix B shows the data supporting Figures 14 and 15, as well as distributions of these expense statistics by deciles.

System-wide from 2009 to 2013, estimated administrative expenses per active participant increased roughly 40%.

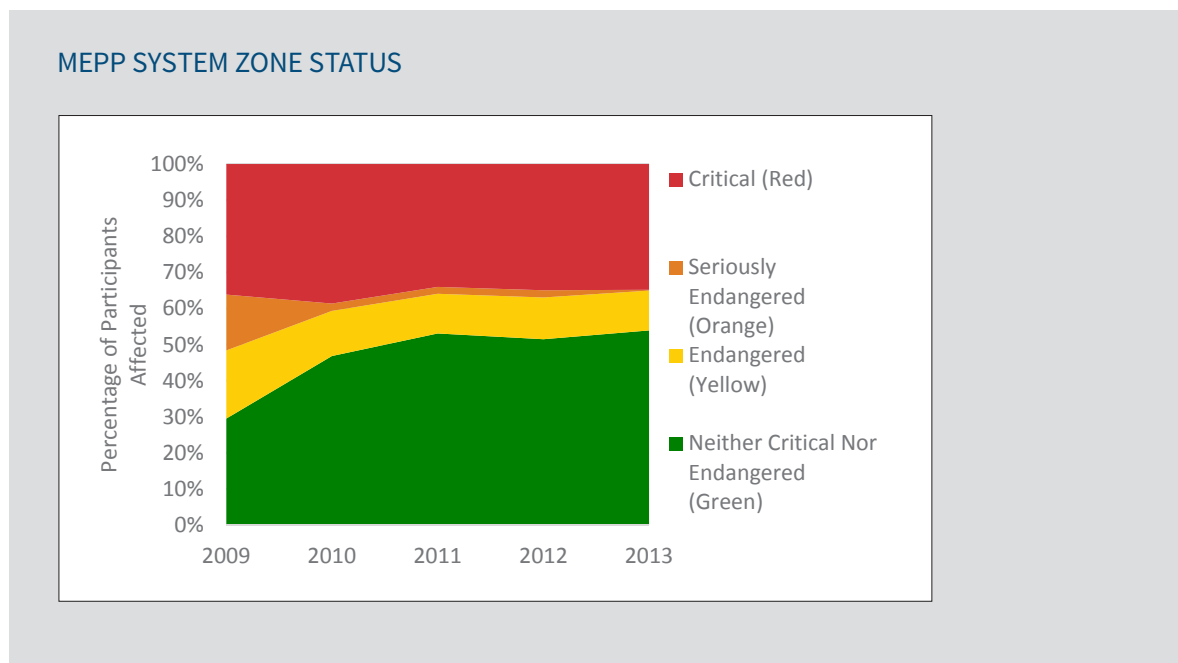
6.2 Administrative Expenses by Industry

Appendix B shows distributions of estimated administrative expenses by industry.

Section 7: Zones Plus Metrics

For good reason, much attention has been given to multiemployer pension plans' status (commonly referred to as "zone") as prescribed by the Pension Protection Act of 2006 (PPA). Status or zones are one way to measure funding risks associated with a plan. For the plan years studied, there are effectively four zones, as shown in Figure 16.

Figure 16



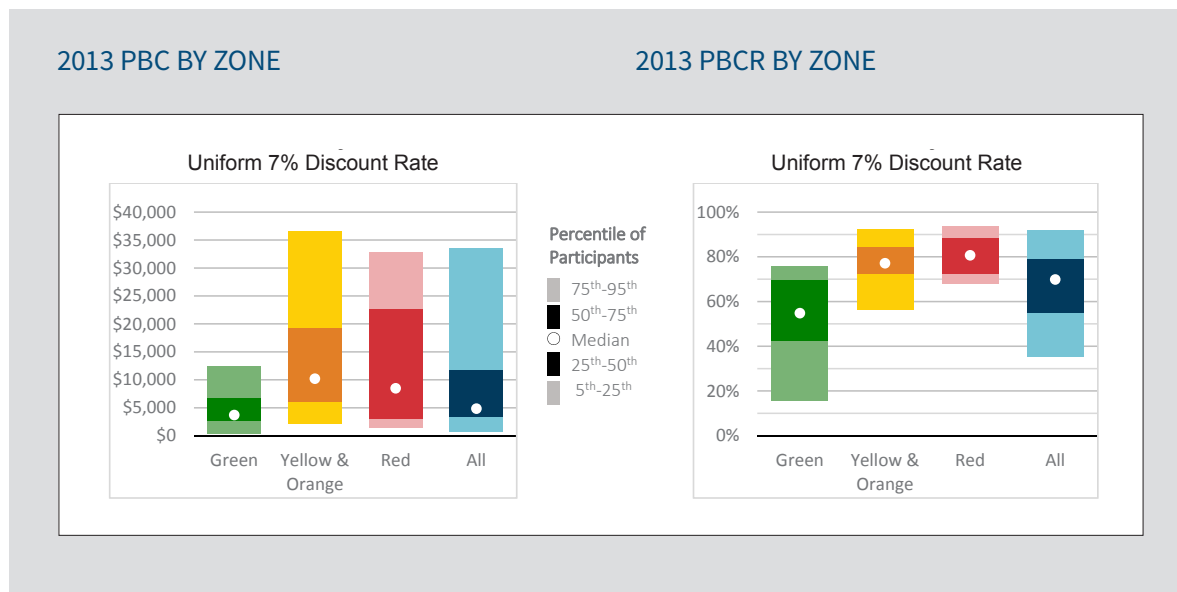
From 2009 through 2013, the proportion of participants in green plans grew significantly, creating a public perception that the system's financial health is improving. However, the proportion of participants in red or critical plans (roughly a third) remained fairly stable over that period—an indication that the system continues to be stressed as measured by zone status.

Zone status is determined for a specific purpose using legally prescribed procedures and includes projections into subsequent years. The PBC and PBCR serve a somewhat different purpose and are determined differently. Among the differences, the PBC and PBCR metrics do not include projections into subsequent years.

Figures 17 and 18 illustrate the distributions of PBCs and PBCRs for 2013 by zone. Like the other distributions presented in this paper, distributions are weighted by participant. While all plans in the universe are represented, a single large plan may cover several percentiles.

Figure 17

Figure 18



When considering this paper’s metrics in conjunction with zones in 2013, some observations stand out:

- Not surprisingly, the lowest metric values—which generally indicate low levels of stress—appear only in the green zone.
- Similarly, the green zone contains none of the highest metric values.
- The highest PBC, however, appears in yellow or orange zones rather than the red zone.
- The PBCR is more closely correlated with the zones than is the PBC, although the correlation is still rather loose.

Analysis of the reasons for differences between metric and zone results is beyond the scope of this paper.

A table of PBC and PBCR data supporting Figures 17 and 18 may be found in Appendix B. The corresponding data for 2009 through 2012 plan years may also be found there.

Section 8: Summary and Future Considerations

8.1 Summary

The U.S. multiemployer pension system is financially stressed by unfunded liabilities attributable to previously accrued benefits. From 2009 through 2013, on an actuarially smoothed basis the system in aggregate remained fairly constant at approximately 75% funded with an unfunded liability of roughly \$130 billion. As measured by Current Liability, the

aggregate unfunded liability increased from \$400 billion to \$500 billion. Across the MEPP system, funding previously accrued benefits made up well over half of annualized plan costs. The vast majority of multiemployer pension plan participants are in plans for which the annualized cost of previously accrued benefits exceeds the combined costs of current benefit accruals and administrative expenses.

The PBC and PBCR metrics look at unfunded liabilities as an economic burden relative to the system's decreasing population of active participants. As measured by these metrics, overall stress levels are increasing. While much of the system is holding steady, the highest stress levels are increasing dramatically. Only the lowest stress levels are declining appreciably.

Multiemployer plans commonly have asset allocations with significant exposure to investment risk. High-risk investments offer the potential reward of high returns, which could greatly alleviate stress. But they also carry the risk of low or negative returns, which could be particularly damaging to plans that are already operating under a high level of stress.

Administrative expenses appear to be another source of financial stress on these plans. Overall, during recent years, estimated expenses have increased substantially both in terms of the dollar amount per active participant and as a portion of annualized pension costs.

Users of the metrics presented in this paper may find it meaningful to track them over time as well as in comparison to other plans in the system. Using them in conjunction with zone status under the Pension Protection Act of 2006 may also be helpful.

8.2 Future Considerations

This paper presents metrics for measuring the stress posed by unfunded liabilities and changing demographics across the MEPP system. The high stress levels observed in this analysis raise the question of how the system might cope in the future. Are stress levels likely to increase or decrease across time? Are there common characteristics among plans that have higher or lower stress levels? Opportunities for further study also include the impact of contribution trends, the Multiemployer Pension Reform Act of 2014, and potential withdrawals from the system.

Appendix A—Data, Assumptions and Methods

A.1 Data

A.1.1 Summary of Plans

Analyses for this paper are based on records from the Department of Labor's Form 5500 database as downloaded on June 18, 2015. Generally, records for ongoing multiemployer defined benefit pension plans are included. Cash balance plans and some incomplete or irregular records are excluded. A summary of the records follows. The table numbers are the same as the corresponding figure in the body of the paper.

Table 1

MEPP SYSTEM ASSETS AND LIABILITIES

In \$Billions	2009	2010	2011	2012	2013 ¹⁷
Plans	1,265	1,252	1,210	1,212	1,212
Participants (millions)	9.5	9.4	9.6	9.6	9.4
Actuarial Basis					
Actuarial Liability	\$493	\$503	\$535	\$564	\$554
Actuarial Value of Assets	\$361	\$401	\$421	\$430	\$425
Unfunded Liability	\$137	\$107	\$118	\$137	\$132
Funded Ratio	73%	80%	79%	76%	77%
Current Liability Basis					
Current Liability	\$698	\$730	\$779	\$848	\$882
Market Value of Assets	\$303	\$340	\$379	\$381	\$392
Unfunded Liability	\$396	\$392	\$401	\$468	\$490
Funded Ratio	43%	47%	49%	45%	45%

Table 2 (Includes Values for Figures 2 and 3)

MULTIEMPLOYER PENSION PLAN FORM 5500 DATA SUMMARY

As of June 18, 2015					
Financial Values in Billions Participant Counts in Millions	2009	2010	2011	2012	2013
Records Available					
Number of Plan Records	1,308	1,298	1,278	1,280	1,149
Total Market Value of Assets	\$305.9	\$344.4	\$385.9	\$389.8	\$386.9
Total Current Liability	\$704.2	\$738.3	\$799.3	\$869.5	\$869.1
Total Unfunded Current Liability	\$399.5	\$396.6	\$414.8	\$481.0	\$482.8
Total Current Liability Normal Cost	\$17.6	\$16.8	\$16.8	\$18.6	\$18.3
Number of Participants	9.61	9.58	9.83	9.85	9.42
Number of Active Participants	3.99	3.76	3.71	3.59	3.47
Ongoing, Non-Cash Balance Plan Records Used					
Number of Plan Records	1,037	\$1,021	\$1,048	\$1,056	\$960
Total Market Value of Assets	\$280.2	\$317.6	\$358.0	\$355.1	\$364.4
Total Current Liability	\$645.6	\$683.3	\$735.7	\$788.2	\$815.8
Total Unfunded Current Liability	\$365.7	\$365.9	\$377.9	\$433.5	\$451.5
Total Current Liability Normal Cost	\$16.4	\$15.7	\$16.2	\$17.6	\$17.4
Number of Participants	8.93	8.89	9.08	9.01	8.58
Number of Active Participants	3.75	3.51	3.45	3.35	3.16
Active Participants as a Percentage of Total	42%	39%	38%	37%	37%

17 *Supra*, note 4.

A.1.2 Discount Rates and Asset Allocations

Table 4

“ACTUARIAL BASIS” DISCOUNT RATE SUMMARY

Number of Plans per Form 5500 Schedule MB					
Valuation Liability Interest Rate	2009	2010	2011	2012	Figure 4 Values 2013¹⁸
5.74% and less	3	3	5	5	4
5.75% to 6.24%	20	17	20	23	18
6.25% to 6.74%	36	38	44	44	45
6.75% to 7.24%	253	241	240	253	234
7.25% to 7.74%	555	559	585	589	546
7.75% to 8.24%	159	155	146	132	106
8.25% to 8.74%	11	8	8	10	7
8.75% and up	0	0	0	0	0
Total	1,037	1,021	1,048	1,056	960
Average	7.37%	7.37%	7.35%	7.33%	7.32%

Table 9

MEPP COLLECTIVE ASSET ALLOCATION¹⁹

Per Form 5500 Schedule R					
Asset Class	2009	2010	2011	2012	Figure 9 Values 2013
Stock	45%	49%	48%	46%	47%
Investment-Grade Debt	26%	24%	22%	22%	21%
Other	18%	17%	18%	20%	20%
Real Estate	7%	7%	7%	8%	8%
High-Yield Debt	3%	4%	5%	4%	4%

18 As reported and publicly available on June 18, 2015.

19 Percentages may not add to 100% due to rounding.

A.2 Methods and Assumptions

A.2.1 Liabilities and Assets

- Uniform basis liabilities and normal cost are estimated from Unit Credit values reported as Current Liability on Schedule MB, with adjustment for different discount rates.
- For liabilities and normal cost on plan actuaries' discount rate basis, Current Liability values are adjusted to the post-retirement valuation liability interest rate reported on Schedule MB.
- For PBC and PBCR calculations, assets used to determine unfunded liability are the market value of assets as reported on Schedule MB.
- Administrative expenses are estimated using expense load assumptions reported on Schedule MB.
- Duration and convexity assumptions for estimating liabilities at different discount rates:

	Duration²⁰	Convexity²¹
Normal Cost	17.5	-1.4
Active Liability	15.5	-1.1
Term Vested Liability	14	-1.0
Retiree Liability	6	-0.4

A.2.2 Sensitivity Analysis

The discount rates selected for sensitivity analysis are based on 15-year forecasts that Moody's provided to the SOA. Moody's supplied 5,000 economic scenarios for various asset classes over 15 years beginning in 2014. Using asset allocations as reported on Form 5500 Schedule R and choosing from the asset classes included in Moody's analysis, the authors estimate the following asset mix among collective MEPP assets:

Asset Class	Allocation
Equity—Domestic	39.3%
Equity—Europe Asia Far East	19.7%
Fixed Income—Intermediate Corporate	23.0%
Fixed Income High Yield	5.0%
Fixed Income Cash	4.0%
Real Estate	9.0%
Total	100.0%

²⁰ Duration values computed at a discount rate of 7.0%.

²¹ Convexity of -1.4 means that an increase in the discount rate of 100 basis points will reduce duration by 1.4.

Appendix B—Detailed Results

Note: Distributions are weighted by the number of participants, and each column is distributed separately. The table number corresponds to the corresponding figure number in the body of the paper.

B.1 Section 4: Metric Results

B.1.1 Graph Values and Additional Percentiles

PREVIOUS BENEFIT COST (PBC)—FIGURES 5 AND 6 VALUES

Percentile of Participants	Table 5 Uniform 7% Discount Rate					Table 6 Plan Actuaries' Discount Rates				
	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013
95 th	23,168	25,800	27,229	31,634	32,741	22,083	24,448	25,787	30,228	31,316
85 th	12,741	13,765	14,241	17,720	17,222	11,572	12,455	12,859	16,617	16,931
75 th	9,360	9,333	9,562	11,402	11,025	8,347	8,384	8,330	10,335	9,806
50th	4,958	5,165	4,693	5,077	4,859	5,070	5,165	4,693	5,077	4,790
25 th	2,503	2,263	2,284	2,683	2,611	2,384	2,117	2,069	2,192	2,154
15 th	1,652	1,764	1,864	2,202	1,940	1,589	1,693	1,551	2,019	1,499
5 th	983	809	456	686	746	831	738	299	507	461

PREVIOUS BENEFIT COST (PBC)—DECILES

Percentile of Participants	Uniform 7% Discount Rate					Plan Actuaries' Discount Rates				
	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013
95 th	23,168	25,800	27,229	31,634	32,741	22,083	24,448	25,787	30,228	31,316
90 th	16,773	17,147	19,104	22,581	23,144	15,620	16,122	17,500	20,508	21,394
80 th	10,527	10,760	11,044	14,470	14,075	9,815	9,647	10,064	13,498	12,802
70 th	8,116	8,327	7,710	9,060	9,089	7,286	7,158	7,014	8,479	8,268
60 th	6,209	6,433	5,985	7,236	7,478	5,706	5,942	5,387	6,698	6,699
50th	4,958	5,165	4,693	5,077	4,859	5,070	5,165	4,693	5,077	4,790
40 th	4,056	3,740	3,426	3,844	3,819	3,787	3,256	3,004	3,310	3,431
30 th	2,695	2,673	2,758	3,207	3,244	2,431	2,413	2,285	2,876	2,949
20 th	2,189	2,212	1,877	2,250	2,234	2,005	1,805	1,788	2,124	2,082
10 th	1,392	1,206	1,102	1,153	928	1,210	1,106	983	1,146	668
5 th	983	809	456	686	746	831	738	299	507	461

PREVIOUS BENEFIT COST RATIO (PBCR)—FIGURES 7 AND 8 VALUES

Percentile of Participants	Table 7 Uniform 7% Discount Rate					Table 8 Plan Actuaries' Discount Rates				
	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013
95 th	87.8%	89.0%	90.0%	91.0%	91.7%	87.5%	89.5%	89.8%	91.2%	92.0%
85 th	82.2%	81.5%	81.5%	85.9%	85.6%	82.1%	81.4%	81.5%	86.2%	86.0%
75 th	75.6%	77.0%	77.2%	78.9%	78.9%	76.0%	76.8%	78.3%	78.7%	79.0%
50th	67.9%	68.6%	68.5%	71.1%	69.9%	67.7%	68.4%	67.8%	70.9%	69.4%
25 th	62.3%	59.6%	57.2%	58.1%	54.8%	61.7%	58.8%	55.9%	58.1%	54.8%
15 th	50.5%	47.5%	44.9%	47.0%	45.8%	49.5%	47.1%	42.5%	45.5%	45.8%
5 th	37.8%	31.0%	30.3%	36.3%	35.3%	36.4%	28.3%	25.3%	33.4%	29.4%

PREVIOUS BENEFIT COST RATIO (PBCR)—DECILES

Percentile of Participants	Uniform 7% Discount Rate					Plan Actuaries' Discount Rates				
	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013
95 th	87.8%	89.0%	90.0%	91.0%	91.7%	87.5%	89.5%	89.8%	91.2%	92.0%
90 th	83.4%	88.6%	87.9%	88.7%	88.6%	83.8%	88.8%	88.2%	89.0%	88.9%
80 th	79.4%	79.8%	79.6%	82.0%	81.4%	79.6%	79.9%	79.4%	81.9%	81.0%
70 th	73.7%	75.0%	74.3%	77.8%	76.4%	74.2%	75.0%	74.7%	77.8%	76.3%
60 th	69.8%	72.2%	69.7%	72.4%	72.2%	69.9%	71.5%	69.3%	72.4%	72.3%
50th	67.9%	68.6%	68.5%	71.1%	69.9%	67.7%	68.4%	67.8%	70.9%	69.4%
40 th	64.3%	64.0%	64.8%	68.1%	65.5%	64.0%	64.0%	64.6%	67.4%	65.3%
30 th	63.6%	62.7%	58.3%	59.0%	56.8%	63.8%	62.7%	58.3%	58.1%	55.1%
20 th	57.1%	55.4%	48.3%	52.4%	51.8%	56.7%	52.1%	47.0%	50.6%	49.7%
10 th	41.2%	41.7%	34.9%	41.3%	40.6%	40.9%	40.1%	33.4%	36.4%	35.3%
5 th	37.8%	31.0%	30.3%	36.3%	35.3%	36.4%	28.3%	25.3%	33.4%	29.4%

B.1.2 By Industry

2013 PREVIOUS BENEFIT COST (PBC) BY INDUSTRY

Percentile of Participants	Uniform 7% Discount Rate						Industry Group		
	Industry						ALL Plans	Con-struction	All Other Industries
	Con-struction	Trans- portation and Ware- housing	Retail/ Wholesale	Manufac- turing	Leisure and Hospitality	Other			
95 th	22,714	32,741	4,991	25,180	4,906	36,565	32,741	22,714	32,741
90 th	17,561	32,741	4,991	18,126	4,906	25,346	23,144	17,561	32,741
80 th	12,681	32,741	4,818	16,479	2,234	13,026	14,075	12,681	16,154
70 th	9,854	32,741	2,868	13,599	2,234	8,631	9,089	9,854	8,484
60 th	8,368	19,281	1,756	8,703	2,234	6,134	7,478	8,368	4,906
50th	8,036	9,258	928	8,484	2,234	4,430	4,859	8,036	4,790
40 th	6,480	4,790	928	2,611	2,234	3,716	3,819	6,480	3,336
30 th	4,168	4,790	751	2,611	2,186	3,716	3,244	4,168	2,234
20 th	3,244	4,790	751	2,611	1,078	2,334	2,234	3,244	1,644
10 th	3,087	4,790	751	2,611	848	1,139	928	3,087	751
5 th	2,888	4,790	170	746	159	227	746	2,888	313

2013 PREVIOUS BENEFIT COST (PBC) BY INDUSTRY

Percentile of Participants	Plan Actuaries' Discount Rates						Industry Group		
	Industry						ALL Plans	Con-struction	All Other Industries
	Con-struction	Trans- portation and Ware- housing	Retail/ Wholesale	Manufac- turing	Leisure and Hospitality	Other			
95 th	21,394	31,316	4,592	24,204	4,383	33,465	31,316	21,394	31,316
90 th	16,467	31,316	4,592	17,431	4,383	23,480	21,394	16,467	31,316
80 th	11,785	31,316	4,335	17,332	2,154	12,013	12,802	11,785	14,900
70 th	8,760	31,316	2,592	12,474	2,154	7,409	8,268	8,760	7,719
60 th	7,835	18,249	1,499	8,703	2,154	5,699	6,699	7,835	4,790
50th	6,943	8,033	668	7,934	2,154	4,081	4,790	6,943	4,335
40 th	5,919	4,790	668	2,082	2,154	3,094	3,431	5,919	2,981
30 th	3,775	4,790	504	2,082	1,918	3,094	2,949	3,775	2,154
20 th	2,949	4,790	461	2,082	1,078	1,410	2,082	2,949	1,249
10 th	2,864	4,790	461	2,082	921	518	668	2,864	461
5 th	2,478	4,790	93	317	-144	159	461	2,478	248

2013 PREVIOUS BENEFIT COST RATIO (PBCR) BY INDUSTRY

Percentile of Participants	Uniform 7% Discount Rate						Industry Group		
	Industry						ALL Plans	Con-struction	All Other Industries
	Con-struction	Trans- portation and Ware- housing	Retail/ Wholesale	Manufac- turing	Leisure and Hospitality	Other			
95 th	87.6%	92.1%	82.8%	94.8%	82.2%	92.6%	91.7%	87.6%	92.6%
90 th	83.0%	88.6%	80.7%	93.6%	72.2%	92.1%	88.6%	83.0%	88.6%
80 th	77.9%	88.6%	80.7%	91.1%	72.2%	78.0%	81.4%	77.9%	86.3%
70 th	74.3%	88.6%	80.7%	86.5%	72.2%	72.4%	76.4%	74.3%	78.9%
60 th	72.6%	84.7%	68.0%	86.5%	72.2%	71.2%	72.2%	72.6%	72.2%
50th	69.9%	69.7%	61.9%	78.9%	72.2%	70.6%	69.9%	69.9%	70.5%
40 th	69.5%	54.8%	61.9%	60.3%	72.2%	60.1%	65.5%	69.5%	60.1%
30 th	66.6%	54.8%	41.7%	38.8%	56.2%	51.5%	56.8%	66.6%	54.8%
20 th	59.8%	54.8%	41.7%	38.8%	45.8%	51.5%	51.8%	59.8%	49.2%
10 th	48.9%	54.8%	41.7%	38.8%	39.3%	35.3%	40.6%	48.9%	38.8%
5 th	40.6%	54.8%	10.8%	38.8%	8.9%	15.5%	35.3%	40.6%	22.8%

2013 PREVIOUS BENEFIT COST RATIO (PBCR) BY INDUSTRY

Percentile of Participants	2013 Previous Benefit Cost Ratio (PBCR) by Industry						Industry Group		
	Plan Actuaries' Discount Rates						ALL Plans	Con-struction	All Other Industries
	Con-struction	Trans- portation and Ware- housing	Retail/ Wholesale	Manufac- turing	Leisure and Hospitality	Other			
95 th	87.7%	92.7%	83.3%	94.9%	81.7%	93.0%	92.0%	87.7%	93.0%
90 th	83.1%	88.9%	80.5%	93.8%	72.3%	92.1%	88.9%	83.1%	88.9%
80 th	77.4%	88.9%	80.5%	91.1%	72.3%	77.9%	81.0%	77.4%	86.2%
70 th	73.8%	88.9%	80.0%	86.2%	72.3%	72.4%	76.3%	73.8%	79.0%
60 th	72.5%	84.9%	66.2%	86.2%	72.3%	70.8%	72.3%	72.5%	72.3%
50th	69.4%	69.2%	55.7%	79.0%	72.3%	70.7%	69.4%	69.4%	70.6%
40 th	69.2%	54.8%	55.7%	56.6%	72.3%	58.8%	65.3%	69.2%	55.7%
30 th	65.5%	54.8%	32.1%	35.3%	54.8%	49.7%	55.1%	65.5%	54.8%
20 th	57.9%	54.8%	32.1%	35.3%	45.8%	49.7%	49.7%	57.9%	47.9%
10 th	46.2%	54.8%	32.1%	35.3%	45.8%	29.2%	35.3%	46.2%	32.1%
5 th	40.1%	54.8%	12.3%	35.3%	0.0%	4.8%	29.4%	40.1%	15.5%

2009–2013 PREVIOUS BENEFIT COST (PBC) BY INDUSTRY GROUP

Percentile of Participants	Uniform 7% Discount Rate									
	Construction					Other Industries				
	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013
95 th	16,773	16,397	17,777	21,746	22,714	23,168	25,800	27,229	31,634	32,741
90 th	13,216	14,051	14,467	17,915	17,561	23,168	25,800	27,229	31,634	32,741
80 th	10,481	11,290	11,487	13,564	12,681	10,527	10,266	11,044	15,095	16,154
70 th	9,360	9,144	8,831	10,361	9,854	6,678	6,596	6,475	8,331	8,484
60 th	7,968	8,327	7,559	8,430	8,368	5,004	5,165	4,693	5,077	4,906
50th	6,551	6,887	7,082	7,966	8,036	4,958	4,813	4,492	4,802	4,790
40 th	5,358	5,293	5,456	6,393	6,480	3,008	3,096	2,953	3,149	3,336
30 th	3,985	3,450	3,854	4,581	4,168	2,505	2,215	2,011	2,250	2,234
20 th	2,503	2,673	2,758	3,295	3,244	1,652	1,764	1,864	2,200	1,644
10 th	2,503	2,673	2,758	3,227	3,087	1,153	1,069	692	797	751
5 th	2,205	2,157	2,284	2,754	2,888	531	357	120	417	313

2009–2013 PREVIOUS BENEFIT COST (PBC) BY INDUSTRY GROUP

Percentile of Participants	Plan Actuaries' Discount Rates									
	Construction					Other Industries				
	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013
95 th	15,620	15,299	16,471	20,397	21,394	22,083	24,448	25,787	30,228	31,316
90 th	12,333	12,920	13,167	16,837	16,467	22,083	24,448	25,787	30,228	31,316
80 th	9,666	10,159	10,472	12,498	11,785	9,815	9,556	9,548	15,494	14,900
70 th	8,311	8,230	7,741	9,177	8,760	6,271	5,952	5,900	7,583	7,719
60 th	7,329	7,158	6,891	7,690	7,835	5,070	5,165	4,693	5,077	4,790
50th	6,275	6,555	6,285	7,148	6,943	4,661	4,453	3,930	4,233	4,335
40 th	5,098	4,931	5,029	5,929	5,919	2,702	2,413	2,285	2,682	2,981
30 th	3,725	3,174	3,563	4,291	3,775	2,202	1,805	1,788	2,124	2,154
20 th	2,384	2,540	2,611	3,146	2,949	1,491	1,693	1,551	1,682	1,249
10 th	2,384	2,540	2,483	2,876	2,864	1,097	778	395	507	461
5 th	2,096	2,117	2,130	2,597	2,478	451	294	83	169	248

2009–2013 PREVIOUS BENEFIT COST RATIO (PBCR) BY INDUSTRY GROUP

Percentile of Participants	Uniform 7% Discount Rate									
	Construction					Other Industries				
	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013
95 th	80.1%	80.7%	81.4%	87.4%	87.6%	89.3%	90.0%	90.5%	92.1%	92.6%
90 th	75.5%	79.4%	79.2%	82.9%	83.0%	83.4%	88.6%	87.9%	88.7%	88.6%
80 th	72.5%	75.0%	74.3%	77.0%	77.9%	82.7%	83.6%	82.5%	85.5%	86.3%
70 th	71.0%	72.2%	71.6%	74.4%	74.3%	77.8%	77.3%	77.8%	78.9%	78.9%
60 th	68.7%	69.6%	68.7%	71.1%	72.6%	72.7%	73.5%	71.0%	74.4%	72.2%
50th	67.9%	68.6%	68.1%	71.1%	69.9%	67.7%	66.8%	69.4%	72.3%	70.5%
40 th	66.7%	67.9%	67.7%	70.3%	69.5%	63.9%	62.7%	59.9%	60.5%	60.1%
30 th	62.4%	63.8%	64.3%	65.5%	66.6%	63.6%	62.7%	58.3%	58.1%	54.8%
20 th	56.7%	59.3%	56.9%	60.5%	59.8%	57.9%	50.0%	45.8%	47.6%	49.2%
10 th	49.2%	48.8%	48.0%	51.3%	48.9%	37.9%	32.0%	30.3%	36.3%	38.8%
5 th	40.8%	36.7%	34.4%	39.0%	40.6%	36.6%	29.5%	25.2%	30.1%	22.8%

2009–2013 PREVIOUS BENEFIT COST RATIO (PBCR) BY INDUSTRY GROUP

Percentile of Participants	Uniform 7% Discount Rate									
	Construction					Other Industries				
	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013
95 th	80.1%	80.7%	81.4%	87.4%	87.6%	89.3%	90.0%	90.5%	92.1%	92.6%
90 th	75.5%	79.4%	79.2%	82.9%	83.0%	83.4%	88.6%	87.9%	88.7%	88.6%
80 th	72.5%	75.0%	74.3%	77.0%	77.9%	82.7%	83.6%	82.5%	85.5%	86.3%
70 th	71.0%	72.2%	71.6%	74.4%	74.3%	77.8%	77.3%	77.8%	78.9%	78.9%
60 th	68.7%	69.6%	68.7%	71.1%	72.6%	72.7%	73.5%	71.0%	74.4%	72.2%
50th	67.9%	68.6%	68.1%	71.1%	69.9%	67.7%	66.8%	69.4%	72.3%	70.5%
40 th	66.7%	67.9%	67.7%	70.3%	69.5%	63.9%	62.7%	59.9%	60.5%	60.1%
30 th	62.4%	63.8%	64.3%	65.5%	66.6%	63.6%	62.7%	58.3%	58.1%	54.8%
20 th	56.7%	59.3%	56.9%	60.5%	59.8%	57.9%	50.0%	45.8%	47.6%	49.2%
10 th	49.2%	48.8%	48.0%	51.3%	48.9%	37.9%	32.0%	30.3%	36.3%	38.8%
5 th	40.8%	36.7%	34.4%	39.0%	40.6%	36.6%	29.5%	25.2%	30.1%	22.8%

B.2 Section 5: Sensitivity Analysis

B.2.1 Graph Values and Additional Percentiles

Table 13

2013 PBC SENSITIVITY ANALYSIS—FIGURE 13 VALUES

Percentile of Participants	Return on Assets				
	4.0%	5.5%	7.0%	8.5%	10.0%
95 th	\$43,279	\$37,545	\$32,741	\$28,700	\$25,310
85 th	26,246	21,745	17,222	13,898	11,685
75 th	18,244	14,353	11,025	8,236	6,238
50th	10,652	7,501	4,859	3,419	1,900
25 th	5,413	4,218	2,611	1,787	356
15 th	3,414	2,769	1,940	1,008	-219
5 th	2,333	1,706	746	-82	-944

2013 PBC SENSITIVITY ANALYSIS—DECILES

Percentile of Participants	4.0%	5.5%	6.0%	6.5%	7.0%	7.5%	8.0%	8.5%	10.0%
95 th	43,279	37,545	35,850	34,251	32,741	31,316	29,970	28,700	25,310
90 th	32,360	27,727	25,591	24,111	23,144	22,399	21,321	20,017	16,896
80 th	22,268	18,133	16,941	15,502	14,075	13,025	11,998	11,005	8,290
70 th	15,201	11,863	10,833	9,919	9,089	8,268	7,458	7,034	5,228
60 th	11,918	9,609	8,978	8,130	7,478	6,592	5,682	5,030	3,259
50th	10,652	7,501	6,554	5,651	4,859	4,383	3,898	3,419	1,900
40 th	7,127	5,406	5,018	4,683	3,819	3,296	2,898	2,429	1,495
30 th	5,630	4,232	3,884	3,555	3,244	2,949	2,615	2,273	773
20 th	4,534	3,088	2,770	2,470	2,234	2,076	1,664	1,321	356
10 th	2,815	1,787	1,511	1,238	928	668	420	182	-473
5 th	2,333	1,706	1,372	1,054	746	422	184	-82	-944

B.2.2 By Industry Group

2013 PBC SENSITIVITY ANALYSIS BY INDUSTRY GROUP

Percentile of Participants	Construction					Other Industries				
	4.0%	5.5%	7.0%	8.5%	10.0%	4.0%	5.5%	7.0%	8.5%	10.0%
95 th	32,466	27,158	22,714	18,965	15,828	43,279	37,545	32,741	28,700	25,310
90 th	26,779	22,025	17,561	14,231	12,081	43,279	37,545	32,741	28,700	24,775
80 th	21,496	16,548	12,681	9,879	7,265	23,022	19,490	16,154	12,666	9,723
70 th	17,385	13,133	9,854	7,675	6,172	12,566	10,336	8,484	6,305	3,851
60 th	14,659	11,060	8,368	6,412	4,640	10,652	7,501	4,906	3,670	2,571
50th	13,071	10,295	8,036	5,463	3,259	8,434	6,327	4,790	2,429	1,412
40 th	11,284	8,975	6,480	4,073	2,187	6,456	5,016	3,336	2,291	742
30 th	7,684	5,887	4,168	2,407	1,694	4,303	3,088	2,234	1,460	356
20 th	5,413	4,232	3,244	2,407	1,694	3,414	2,593	1,644	966	-219
10 th	5,413	4,232	3,087	2,048	572	2,544	1,706	751	-24	-677
5 th	5,413	4,112	2,888	1,494	-695	2,116	1,161	313	-133	-1,221

B.3 Section 6: Administrative Expenses

B.3.1 Graph Values and Additional Percentiles

ESTIMATED ADMINISTRATIVE EXPENSES—FIGURES 14 AND 15 VALUES

Percentile of Participants	Table 14 Per Active Participant					Table 15 As a Percentage of Annualized Plan Cost ²² Plan Actuaries' Discount Rates				
	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013
95 th	\$644	\$763	\$838	\$876	\$837	10.3%	11.1%	13.8%	12.2%	12.3%
85 th	367	462	516	521	541	5.7%	6.5%	7.7%	7.4%	8.1%
75 th	318	384	417	449	458	4.2%	5.3%	5.4%	5.0%	5.3%
50th	220	266	282	303	312	2.9%	3.7%	4.0%	3.7%	3.7%
25 th	121	139	130	133	141	2.0%	2.2%	2.4%	2.2%	2.2%
15 th	86	109	105	118	117	1.4%	1.6%	1.7%	1.6%	1.8%
5 th	60	94	87	89	88	1.0%	1.3%	1.3%	1.2%	1.4%

22 Annualized plan cost is defined the same as for PBCR and includes the Unit Credit cost of current benefit accruals, amortized unfunded liability and administrative expenses.

ESTIMATED ADMINISTRATIVE EXPENSES—DECILES

Percentile of Participants	Per Active Participant					As a Percentage of Annualized Plan Cost ²³ Plan Actuaries' Discount Rates				
	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013
95 th	\$644	\$763	\$838	\$876	\$837	10.3%	11.1%	13.8%	12.2%	12.3%
90 th	460	540	605	622	677	7.2%	8.5%	10.4%	9.4%	9.8%
80 th	367	433	466	480	497	4.9%	5.7%	6.0%	5.9%	6.2%
70 th	292	333	354	383	403	3.8%	4.8%	4.8%	4.7%	5.1%
60 th	267	290	313	348	366	3.7%	4.0%	4.4%	4.1%	4.2%
50th	220	266	282	303	312	2.9%	3.7%	4.0%	3.7%	3.7%
40 th	154	197	219	220	240	2.5%	2.7%	3.1%	2.8%	2.9%
30 th	121	147	143	151	164	2.3%	2.5%	2.6%	2.2%	2.2%
20 th	105	127	124	131	125	1.6%	1.8%	2.2%	2.0%	2.0%
10 th	85	94	101	99	93	1.3%	1.6%	1.6%	1.4%	1.4%
5 th	60	94	87	89	88	1.0%	1.3%	1.3%	1.2%	1.4%

B.3.2 By Industry

2013 ESTIMATED ADMINISTRATIVE EXPENSES PER ACTIVE PARTICIPANT

Percentile of Participants	Industry						Industry Group		
	Con- struction	Trans- portation and Ware- housing	Retail/ Wholesale	Manufac- turing	Leisure and Hospitality	Other	ALL Plans	Con- struction	All Other Industries
95 th	821	1,064	422	799	730	936	837	821	838
90 th	629	722	171	781	730	722	677	629	716
80 th	512	497	148	660	146	496	497	512	497
70 th	401	497	148	428	125	349	403	401	412
60 th	322	497	134	428	125	318	366	322	366
50th	266	433	133	344	125	290	312	266	318
40 th	233	366	123	312	125	287	240	233	282
30 th	191	366	117	312	125	208	164	191	148
20 th	141	366	117	312	110	164	125	141	125
10 th	93	366	99	312	88	79	93	93	117
5 th	93	366	68	295	88	79	88	93	79

²³ *Supra*, note 19.

2013 ESTIMATED ADMINISTRATIVE EXPENSES AS A PERCENT OF ANNUALIZED PLAN COST ²⁴

Percentile of Participants	Plan Actuaries' Discount Rates						Industry Group		
	Industry						ALL Plans	Con-struction	All Other Industries
	Con-struction	Trans- portation and Ware- housing	Retail/ Wholesale	Manufac- turing	Leisure and Hospitality	Other			
95 th	8.4%	12.3%	11.3%	19.4%	13.6%	16.1%	12.3%	8.4%	13.6%
90 th	6.2%	4.4%	10.3%	8.1%	9.8%	9.4%	9.8%	6.2%	10.3%
80 th	4.0%	4.2%	10.3%	6.9%	8.1%	7.3%	6.2%	4.0%	8.1%
70 th	3.1%	4.2%	9.9%	5.3%	4.2%	5.8%	5.1%	3.1%	5.3%
60 th	2.5%	4.2%	9.8%	5.3%	4.2%	5.1%	4.2%	2.5%	4.6%
50th	2.2%	4.2%	9.8%	5.3%	4.2%	5.1%	3.7%	2.2%	4.2%
40 th	2.2%	2.9%	4.8%	4.9%	4.2%	3.7%	2.9%	2.2%	4.2%
30 th	2.0%	1.4%	3.3%	3.4%	4.2%	3.5%	2.2%	2.0%	3.4%
20 th	1.9%	1.4%	2.3%	2.5%	3.7%	2.5%	2.0%	1.9%	2.3%
10 th	1.5%	1.4%	2.3%	2.1%	3.7%	1.5%	1.4%	1.5%	1.4%
5 th	1.2%	1.4%	2.3%	2.1%	3.1%	0.2%	1.4%	1.2%	1.4%

LONGITUDINAL ESTIMATED ADMINISTRATIVE EXPENSES PER ACTIVE PARTICIPANT

Percentile of Participants	By Industry Group									
	Construction					Other Industries				
	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013
95 th	591	704	821	825	821	769	878	867	966	838
90 th	450	526	605	616	629	460	555	602	622	716
80 th	362	429	481	472	512	367	433	466	480	497
70 th	295	331	376	387	401	292	333	354	383	412
60 th	247	278	315	309	322	279	300	313	359	366
50th	199	224	251	275	266	260	277	285	309	318
40 th	160	193	233	220	233	154	213	206	211	282
30 th	126	142	157	176	191	121	151	132	146	148
20 th	85	128	143	129	141	107	127	124	131	125
10 th	85	94	101	99	93	83	98	91	100	117
5 th	85	94	101	99	93	52	80	73	81	79

24 *Supra*, note 19.

LONGITUDINAL ESTIMATED ADMINISTRATIVE EXPENSES AS A PERCENT OF ANNUALIZED PLAN COST²⁵

By Industry Group										
Plan Actuaries' Discount Rates										
Percentile of Participants	Construction					Other Industries				
	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013
95 th	6.1%	7.4%	9.1%	8.3%	8.4%	12.1%	14.8%	17.9%	15.2%	13.6%
90 th	4.5%	5.4%	6.3%	5.9%	6.2%	8.7%	9.2%	11.2%	10.8%	10.3%
80 th	3.4%	3.9%	4.3%	3.9%	4.0%	5.6%	6.5%	7.6%	7.1%	8.1%
70 th	2.6%	3.0%	3.3%	3.1%	3.1%	4.7%	5.7%	5.5%	5.0%	5.3%
60 th	2.4%	2.6%	2.8%	2.7%	2.5%	3.8%	4.3%	4.8%	4.7%	4.6%
50th	2.4%	2.5%	2.6%	2.2%	2.2%	3.7%	4.0%	4.4%	4.1%	4.2%
40 th	2.3%	2.5%	2.6%	2.2%	2.2%	3.3%	4.0%	4.1%	4.1%	4.2%
30 th	1.8%	2.1%	2.3%	2.0%	2.0%	2.7%	3.5%	3.7%	3.4%	3.4%
20 th	1.5%	1.6%	1.9%	1.8%	1.9%	2.0%	2.4%	2.3%	2.3%	2.3%
10 th	1.1%	1.4%	1.6%	1.5%	1.5%	1.4%	1.6%	1.6%	1.4%	1.4%
5 th	0.9%	1.3%	1.3%	1.2%	1.2%	1.1%	1.6%	0.9%	1.4%	1.4%

B.4 Section 7: Zones Plus Metrics

B.4.1 Graph Values

Table 17

Table 18

FIGURE 17 VALUES 2013 PBC BY ZONE

FIGURE 18 VALUES 2013 PBCR BY ZONE

Percentile of Participants	Uniform 7% Discount Rate				Uniform 7% Discount Rate			
	Green	Yellow & Orange	Red	All	Green	Yellow & Orange	Red	All
95 th	\$12,204	\$36,565	\$32,741	\$32,741	75.8%	92.6%	93.6%	91.7%
85 th	8,368	24,670	32,741	17,222	69.9%	88.1%	89.0%	85.6%
75 th	6,484	19,281	22,714	11,025	69.9%	84.7%	88.6%	78.9%
50th	3,716	10,217	8,484	4,859	54.8%	77.1%	80.7%	69.9%
25 th	2,355	6,134	3,087	2,611	42.8%	72.4%	72.2%	54.8%
15 th	928	4,859	2,234	1,940	38.8%	65.0%	71.2%	45.8%
5 th	298	2,186	1,371	746	15.5%	56.2%	68.0%	35.3%

25 *Supra*, note 19.

B.4.2 Longitudinal Values 2009–2013

PBC AND PBCR BY ZONE AND YEAR

		Uniform 7% Discount Rate							
		PBC				PBCR			
Percentile of Participants		Green	Yellow & Orange	Red	All	Green	Yellow & Orange	Red	All
2013	95 th	12,204	36,565	32,741	32,741	75.8%	92.6%	93.6%	91.7%
	85 th	8,368	24,670	32,741	17,222	69.9%	88.1%	89.0%	85.6%
	75 th	6,484	19,281	22,714	11,007	69.9%	84.7%	88.6%	78.9%
	50th	3,716	10,217	8,484	4,859	54.8%	77.1%	80.7%	69.9%
	25 th	2,355	6,134	3,087	2,611	42.8%	72.4%	72.2%	54.8%
	15 th	928	4,859	2,234	1,940	38.8%	65.0%	71.2%	45.8%
	5 th	298	2,186	1,371	746	15.5%	56.2%	68.0%	35.3%
2012	95 th	12,234	34,205	31,634	31,634	78.9%	92.1%	93.4%	91.0%
	85 th	8,430	22,548	31,634	17,720	73.7%	88.5%	89.0%	85.9%
	75 th	5,886	20,756	19,637	11,402	71.1%	84.3%	88.7%	78.9%
	50th	3,806	13,689	8,073	5,077	58.1%	76.7%	80.3%	71.1%
	25 th	2,270	7,255	2,807	2,683	45.5%	68.1%	72.4%	58.1%
	15 th	941	4,581	2,202	2,202	39.0%	65.1%	72.3%	47.0%
	5 th	266	2,444	1,492	686	23.2%	60.0%	63.7%	36.3%
2011	95 th	12,078	34,084	27,229	27,229	79.9%	91.7%	91.3%	90.0%
	85 th	8,494	20,382	27,229	14,241	69.7%	83.5%	88.2%	81.5%
	75 th	6,607	17,777	16,002	9,562	68.1%	81.4%	87.9%	77.2%
	50th	3,458	10,382	6,394	4,693	58.3%	75.6%	77.2%	68.5%
	25 th	2,011	5,312	1,877	2,284	44.9%	66.7%	69.4%	57.2%
	15 th	870	3,978	1,864	1,864	31.3%	64.6%	69.4%	44.9%
	5 th	76	2,408	1,421	456	6.4%	54.2%	63.1%	30.3%
2010	95 th	13,881	18,563	25,800	25,800	79.8%	82.3%	91.0%	89.0%
	85 th	9,413	16,397	23,856	13,765	72.2%	79.9%	88.6%	81.5%
	75 th	7,018	14,051	12,756	9,333	68.6%	78.9%	88.2%	77.0%
	50th	4,701	8,276	6,433	5,165	62.7%	74.9%	74.9%	68.6%
	25 th	2,215	4,349	2,175	2,263	47.2%	64.9%	64.0%	59.6%
	15 th	1,069	3,413	1,764	1,764	35.1%	60.1%	64.0%	47.5%
	5 th	253	2,656	1,206	809	15.4%	58.4%	47.5%	31.0%
2009	95 th	9,516	19,867	23,168	23,168	76.7%	86.2%	89.3%	87.8%
	85 th	6,318	11,921	23,168	12,741	67.9%	77.5%	83.4%	82.2%
	75 th	4,958	9,988	16,066	9,360	67.9%	74.8%	83.4%	75.6%
	50th	4,817	5,661	6,678	4,958	63.6%	64.6%	76.3%	67.9%
	25 th	2,503	2,205	3,024	2,503	53.0%	58.4%	69.1%	62.3%
	15 th	1,426	1,652	2,505	1,652	44.4%	45.0%	65.4%	50.5%
	5 th	171	1,153	1,348	983	27.8%	37.8%	52.5%	37.8%

PBC AND PBCR BY ZONE AND YEAR

		Plan Actuaries' Discount Rates							
		PBC				PBCR			
Percentile of Participants		Green	Yellow & Orange	Red	All	Green	Yellow & Orange	Red	All
2013	95 th	11,011	33,465	31,316	31,316	74.9%	93.0%	93.8%	92.0%
	85 th	7,582	23,207	31,316	16,931	69.4%	88.2%	89.2%	86.0%
	75 th	5,863	18,249	21,204	9,806	69.2%	84.9%	88.9%	79.0%
	50th	3,094	9,765	7,934	4,790	54.8%	77.4%	80.5%	69.4%
	25 th	2,065	5,699	2,844	2,154	41.9%	72.2%	72.3%	54.8%
	15 th	668	4,555	2,154	1,499	34.4%	64.7%	70.8%	45.8%
	5 th	66	1,918	1,243	461	3.7%	54.8%	67.1%	29.4%
2012	95 th	10,696	31,047	30,228	30,228	78.7%	92.5%	93.5%	91.2%
	85 th	7,148	20,700	30,228	16,617	73.5%	88.7%	89.0%	86.2%
	75 th	5,559	19,648	18,876	10,335	70.9%	84.6%	89.0%	78.7%
	50th	3,146	12,930	7,690	5,077	58.1%	76.9%	80.2%	70.9%
	25 th	2,019	6,689	2,535	2,192	40.9%	68.3%	72.4%	58.1%
	15 th	812	4,291	2,124	2,019	36.1%	64.1%	72.1%	45.5%
	5 th	132	2,212	1,361	507	14.5%	59.5%	63.7%	33.4%
2011	95 th	10,966	30,516	25,787	25,787	79.8%	92.0%	91.5%	89.8%
	85 th	7,450	19,061	25,787	12,859	68.9%	83.7%	88.2%	81.5%
	75 th	5,920	16,471	15,185	8,330	67.8%	81.5%	88.2%	78.3%
	50th	3,083	9,396	5,900	4,693	58.3%	75.7%	78.3%	67.8%
	25 th	1,551	4,881	1,788	2,069	39.4%	66.6%	69.3%	55.9%
	15 th	713	3,693	1,788	1,551	26.6%	64.6%	68.4%	42.5%
	5 th	-41	2,176	1,161	299	0.0%	52.9%	61.2%	25.3%
2010	95 th	12,455	17,339	24,448	24,448	79.9%	82.2%	91.0%	89.5%
	85 th	8,230	15,212	22,035	12,455	71.5%	80.1%	88.8%	81.4%
	75 th	6,420	12,684	11,235	8,384	68.4%	79.3%	88.2%	76.8%
	50th	4,225	7,858	5,942	5,165	62.7%	74.7%	75.0%	68.4%
	25 th	1,805	3,571	1,965	2,117	47.0%	65.0%	64.0%	58.8%
	15 th	948	3,174	1,693	1,693	32.1%	60.2%	64.0%	47.1%
	5 th	71	2,365	1,083	738	13.4%	57.3%	45.1%	28.3%
2009	95 th	8,519	18,842	22,083	22,083	76.7%	86.3%	89.4%	87.5%
	85 th	5,722	10,868	22,083	11,572	67.7%	78.0%	83.8%	82.1%
	75 th	5,070	9,139	15,148	8,347	67.7%	75.0%	83.8%	76.0%
	50th	4,311	5,299	6,271	5,070	63.8%	64.4%	77.0%	67.7%
	25 th	2,384	2,096	2,824	2,384	51.6%	57.9%	68.5%	61.7%
	15 th	1,455	1,589	2,243	1,589	43.5%	45.0%	65.7%	49.5%
	5 th	141	1,153	1,223	831	18.6%	36.4%	51.1%	36.4%

ABOUT THE SOCIETY OF ACTUARIES

The Society of Actuaries (SOA), formed in 1949, is one of the largest actuarial professional organizations in the world dedicated to serving 24,000 actuarial members and the public in the United States, Canada and worldwide. In line with the SOA Vision Statement, actuaries act as business leaders who develop and use mathematical models to measure and manage risk in support of financial security for individuals, organizations and the public.

The SOA supports actuaries and advances knowledge through research and education. As part of its work, the SOA seeks to inform public policy development and public understanding through research. The SOA aspires to be a trusted source of objective, data-driven research and analysis with an actuarial perspective for its members, industry, policymakers and the public. This distinct perspective comes from the SOA as an association of actuaries, who have a rigorous formal education and direct experience as practitioners as they perform applied research. The SOA also welcomes the opportunity to partner with other organizations in our work where appropriate.

The SOA has a history of working with public policymakers and regulators in developing historical experience studies and projection techniques as well as individual reports on health care, retirement, and other topics. The SOA's research is intended to aid the work of policymakers and regulators and follow certain core principles:

Objectivity: The SOA's research informs and provides analysis that can be relied upon by other individuals or organizations involved in public policy discussions. The SOA does not take advocacy positions or lobby specific policy proposals.

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