
**REPORT
TO ORSC**



**ACTUARIAL AUDIT
FOR THE
OHIO POLICE AND FIRE PENSION FUND**

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October 2017



October 6, 2017

Ohio Retirement Study Council
88 East Broad Street, Suite 1175
Columbus, OH 43215

Re: Ohio Police and Fire Pension Fund (OP&F) Actuarial Audit of the Pension and Health Benefits
as of January 1, 2015

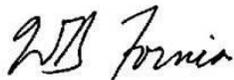
Dear Councilmembers:

We have completed our actuarial audit of the Ohio Police and Fire Pension Fund (OP&F) pursuant to R.C. §171.04(E). As shown in the attached findings, we have matched actuarial calculations quite closely, and have several related comments. None of the comments reflects a critical concern. Our audit finds that actuarial calculations were reasonable, consistent and accurate.

The undersigned are members of the American Academy of Actuaries and meet the Qualification Standards to provide this statement of actuarial opinion.

We are available to answer any questions you may have regarding our findings and recommendations of the actuarial audit.

Sincerely,



William B. Forna, FSA
President
Pension Trustee Advisors



Linda L. Bournival, FSA
Consulting Actuary
KMS Actuaries, LLC

cc: Ohio Police and Fire Pension Fund

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Section 1 – General Findings

The Ohio Statutes require that the Ohio Retirement Study Council (ORSC) contract for an independent audit of the state retirement systems' actuaries not less than once every ten years. ORSC elaborated that the firm conducting the audit is to express an opinion regarding:

- An overall opinion as to the validity, completeness, and appropriateness of the demographic and financial information used by the consulting actuary to meet OP&F's financial objectives,
- An overall opinion as to the reasonableness of the consulting actuary's conclusions and the conformance of the consulting actuary's work with generally accepted actuarial standards and practices, and
- A detailed description of each audit exception and the estimated effects of each exception on OP&F, and
- Detailed recommendations for improvement.

Our opinion is that these standards were met, as will be discussed in the following pages.

Ohio Police and Fire Pension Fund (OP&F) provided retirement benefits and health care benefits. Actuarial values were reported through two actuarial reports:

- OP&F January 1, 2015 Actuarial Valuation of Pension Benefits, dated October 13, 2015
- OP&F January 1, 2015 Actuarial Valuation of Retiree Health Care Benefits under GASB 43, dated October 13, 2015

We have duplicated these January 1, 2015 actuarial valuations conducted by Buck Consultants, now known as Conduent (Buck) and the results match quite closely. This match confirms that Buck is able to capture the complexity of OP&F accurately, and that OP&F should have confidence in the actuarial calculations provided to them. In addition, we reviewed Buck's August 23, 2017 Quinquennial Actuarial Experience Review for 2012 through 2016 and its recommendations.

The primary purpose of an actuarial audit is to confirm that there are no significant errors in the actuarial calculations. Based on our replication, we report that we have found no significant discrepancies and conclude that there are no significant errors. This is confirmed on the tables and discussion below.

Our most significant concern is with Buck's disclosure of calculation methods and assumptions, which is addressed in the following sections.

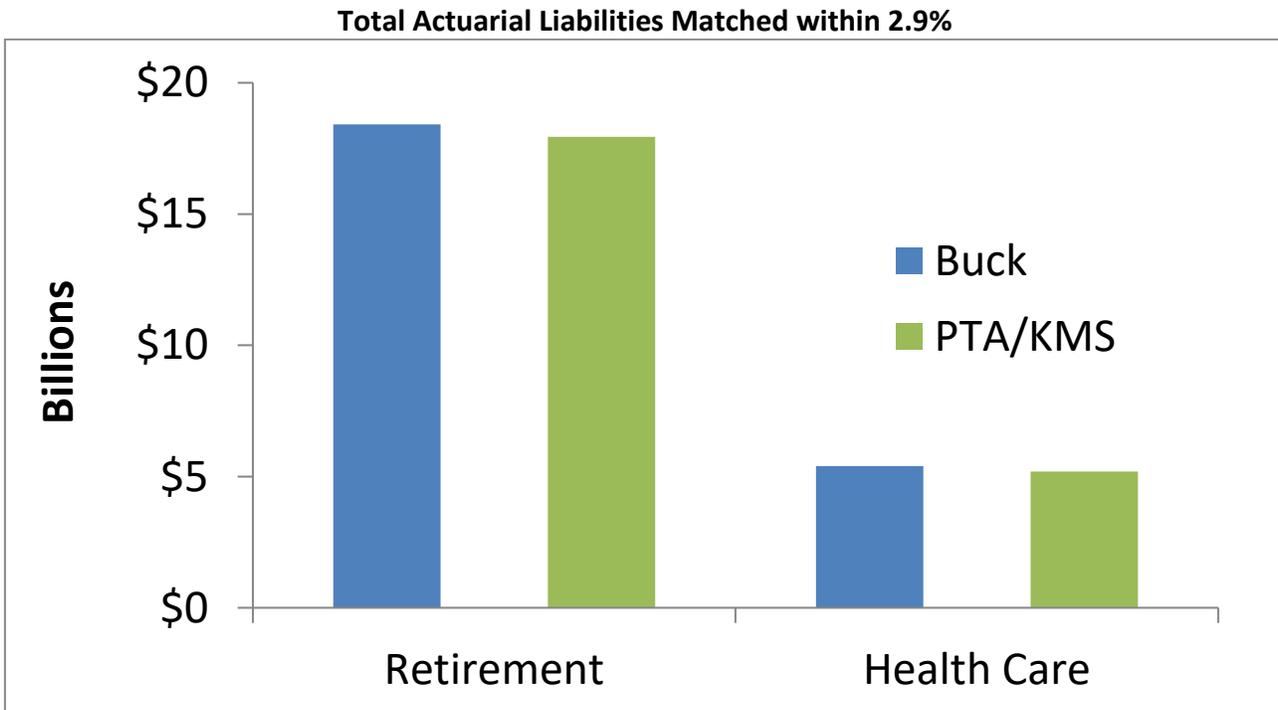
The following tables summarize the actuarial liabilities and normal costs produced by Buck and PTA/KMS actuarial valuations.

Actuarial Liabilities and Normal Cost as of January 1, 2015 (\$ in thousands) - Pension Benefits			
	<u>Buck</u>	<u>PTA/KMS</u>	<u>% Diff.</u>
Present Value of Future Benefits	21,470,374	20,980,485	-2.28%
Accrued Liability	18,415,042	17,937,808	-2.59%
Normal Cost	332,805	324,053	-2.63%

Actuarial Liabilities and Normal Cost as of January 1, 2015 (\$ in thousands) - Health Care Benefits			
	<u>Buck</u>	<u>PTA/KMS</u>	<u>% Diff.</u>
Present Value of Future Benefits	8,221,539	8,073,585	-1.80%
Accrued Liability	5,399,550	5,191,757	-3.85%
Normal Cost	216,966	212,015	-2.28%

The grand total actuarial liability calculated by PTA/KMS was within 2.9% of the same calculated by Buck. Our grand total normal cost was within 2.5% of that calculated by Buck. Both are well within actuarial norms and strong evidence that the Buck actuarial valuations are reliable.

This is illustrated by the following chart:



Although the match was reasonably close, there is still room for improvement. We make the following recommendations for enhancement in the accuracy of calculations and completeness in the reports:

- Correct minor calculations as discussed in the following pages
- Expand disclosure of methodology and assumptions more rigorously in the next actuarial experience study and valuation reports
- Reconsider certain actuarial assumptions in the next experience study, including:
 - Percentage of employees who do not retire when first eligible enter DROP
 - Marriage rates
 - Age difference between husbands and wives
 - Number of dependents
 - Annuity option selection
 - Administrative expenses
 - Short-term return on employer assets
 - Gross claim rate derivation
 - Morbidity
 - Health plan participation rates and elections

Section 2 – Audit of Actuarial Methods, Factors and Assumptions

The first step in the actuarial audit process is to review the actuarial methods, actuarial factors and actuarial assumptions used in the actuarial valuations.

ACTUARIAL METHODS

Buck uses several actuarial methods in determining costs and liabilities for OP&F.

- The actuarial funding method is the Individual Entry Age actuarial cost method
- The actuarial asset valuation method for pension is a four-year smoothed market value
- The amortization of the unfunded actuarial accrued liability is based on level payroll, closed period method
- The method of developing the health care claims cost assumptions is not clearly described in the reports.

Actuarial Funding Method

The Individual Entry Age Normal actuarial cost method is used for both actuarial valuations. This method is designed to maintain constant plan costs throughout each employee’s career as a portion of pay. We believe this is a reasonable and appropriate method. It is the most common method used by large public pension systems such as OP&F. Buck is applying the method reasonably, consistently and accurately.

Actuarial Asset Valuation Method

Buck employs a four-year smoothed market value actuarial asset valuation method for the retirement plan actuarial valuation. Unlike actuarial funding methods, actuarial asset valuation methods are not precisely defined. Most actuaries use what could be categorized as a “five- [or four-] year smoothed market value actuarial asset valuation method” as does Buck, but might use quite different methods. We have reviewed the precise provisions of the method that Buck employs and find them to be reasonable, consistently applied, and accurate.

The Buck method is a very conventional and appropriate application of a four-year smoothed method. They spread any investment gains or losses (relative to the actuarial assumption) over four years and apply a 20% maximum disparity from true market value. This is a reasonable and appropriate method.

Amortization Method for Determining Funding Amounts

In addition to the Entry Age Normal actuarial cost method, Buck and OP&F use a conventional method for amortizing components of unfunded liability. The method was a closed period, which decreased from 33 years as of January 1, 2014 to 30 years as of January

1, 2015. Since then, it has fallen to 29 years as of January 1, 2016, but is anticipated to increase with the adoption of proposed changes in actuarial assumptions. OP&F only tests this for thirty-year compliance every three years, with the actuarial valuation as of January 1, 2019 being the third year. Despite making the attainment of a thirty-year funding period more challenging we encourage the board to adopt the proposed OP&F assumption changes.

The funding period is calculated by subtracting the employer normal cost from the total employer contributions, and then measuring how many years it would require to fully amortize the unfunded retirement liability from these contributions. While this would tend to decrease every year (by one year if all actuarial assumptions are met), there will certainly be years when the period rises. OP&F struggles to maintain a funding period of 30 years, due to volatile investment return, strengthening of actuarial assumptions, and the provision of health care benefits, which, although modest, prevent the funded status from otherwise improving.

Many if not most statewide pension systems continue to use an open period to amortize the unfunded liability. The closed period approach tends to be more conservative than the open period approach. As discussed in our 2011 Pension Reform Solutions report, we believe that the closed period is more appropriate.

The other amortization feature being used is to amortize the costs as a constant percentage of payroll. With payroll growing at an assumed rate of 3.75% per year, this maintains steady costs. An alternative would be to amortize costs in constant dollars, which would result in higher costs in early years when expressed as a percentage of pay. We believe this is a reasonable approach for funding, despite the changes in the GASB rules which will not permit this method for GASB determinations. The 3.75% payroll growth rate is reasonable in the aggregate based on a stable population. Buck has proposed a reduction in the 3.75% payroll growth rate to 3.25%, based on a decrease in the assumed inflation rate from 3.25% to 2.75%. We note that the number of covered defined benefit members has dropped somewhat since 2009, for example, from 28,927 as of January 1, 2009 to 27,446 as of January 1, 2016. While this is only a 5% reduction over seven years, if the trend continues, it undermines the benefit of assuming that payroll increases by 3.25%. We recommend that Buck explicitly consider this in their next experience study. While 3.25% might be an appropriate price inflation assumption, if population is forecasted to decline, OP&F may wish to adjust its total payroll growth assumption in order to minimize the likelihood of increasing costs.

In conclusion, at this point we find the amortization method reasonable, consistent and accurate.

ACTUARIAL ASSUMPTIONS

We have reviewed the actuarial assumptions used by the actuary and find them to be reasonable, consistent, and accurate. Buck presented their Quinquennial Actuarial Experience Review for 2012 through 2016 last month. We found this presentation to be thorough, appropriate and very clearly presented. We encourage the OP&F Board to adopt the proposed assumption changes.

The actuary uses a large number of actuarial assumptions, including:

- Demographic Assumptions
 - Post-Retirement Mortality
 - Disabled Post-Retirement Mortality
 - Pre-Retirement Mortality
 - Withdrawal from Service Before Retirement
 - Retirement
 - Disability Retirement
 - Other Demographic Assumptions
- Economic Assumptions
 - Investment Return Rate
 - Inflation
 - Wage Inflation
 - Individual Salary Increases
- Post-Employment Healthcare Assumptions
 - Gross Claim Rate Derivation
 - Health Care Cost Trend Rate
 - Morbidity
 - Retiree – Paid Premiums
 - Health Plan Participation Rates and Elections

Detailed comments on each assumption are included below.

DEMOGRAPHIC ASSUMPTIONS

Rates of Post-Retirement Mortality

Actuaries are getting more sophisticated in their techniques for anticipating future mortality improvements. Buck is using the more sophisticated method of a “generational” mortality table which assigns different mortality probabilities based not only on age but on generation. For example, an 80-year old retiree in 2017 (born in 1937) would have higher mortality rates than a future 80-year old retiree born in 1987. Buck began using this more robust methodology in 2009, despite the complexities of actuarial benefit factors, which incorporate mortality assumptions. With the generational table

being used, either the factors need to change every year, or the policy would need to change.

Buck has proposed changing the mortality projection basis from a projection Scale AA to their own Conduent modified MP-2016 projection scale. Mortality improvement projection has been a very controversial issue in the past few years.

Many trends have contributed to lengthening life expectancies, including:

- Continued eradication of diseases
- Advances in medicine
- Advances in nutrition
- Improved access to medical care

But other trends may suggest that life expectancies may not continue to improve, including:

- Obesity
- Many factors which improved mortality are one-time, and cannot be repeated, for example, smoking cessation trends (one can only quit smoking once)
- More sedentary lifestyles
- Substance abuse
- Climate change
- Emergence of new diseases

As a result of the uncertainty of these contrary trends, we endorse Buck's consideration of the Conduent Modified MP-2016 rather than other projection scales such as the Society of Actuaries' MP-2016 which suggest greater mortality improvement.

Buck's proposed modification in mortality assumption for retired Firefighters appears reasonable, based on 893 deaths in the five-year period, when 773 were expected. Similarly, Buck's proposed alteration in mortality assumption for retired Police also appears reasonable, based on 940 deaths in the five-year period, when 1,002 were expected.

Rates of Disabled Post-Retirement Mortality

Buck's proposed alteration in mortality assumption for disabled Police and Firefighters appears reasonable, based on recent experience. We have some concern that the substantial changes for younger disabled retirees may result in mortality rates even lower than active members. For example, consider a disabled firefighter age 40. The current methodology is to use a three-year set-forward, or assume an age 43 raw rate

(0.1299%). For a healthy active firefighter, a six-year set-back is employed, meaning an age 34 raw rate (0.0702%). But experience has shown much lower mortality rates for younger disabled members than expected. The recent experience study recommended adjusting for this by multiplying certain rates by 35%. This would result in a new rate of 0.0455%, which is lower than the healthy firefighter rate. We recommend that this be explored further. It seems hard to justify rates that assume such a large disparity between healthy firefighters and disabled firefighters. While there are certainly risks of these hazardous duty occupations, the experience and current assumptions find that the overall excellent health of Ohio Police and Fire outweighs the occupational risks and that they have lower mortality risks than the general public.

Rates of Pre-Retirement Mortality

Buck's proposed pre-retirement mortality assumption also appears reasonable, and based on 117 deaths in the five-year period, where 130 were expected.

Withdrawal from Service before Retirement

We concur that the withdrawal tables used by Buck are reasonable, consistent and accurate. Buck uses a table based on age and service rather than one based only on age. We find that this is a sound methodology because individuals do have higher likelihood of termination during their first few years of employment than later in their career. Buck also varies the rates between police and firefighters. This would result in more consistency between overall pension plan experience and that predicted by the actuarial assumptions.

The Buck experience study appropriately balanced prior assumptions with recent experience and considered the credibility of the data effectively.

Retirement

We concur that the retirement tables used by Buck are reasonable, consistent and accurate. Buck uses different retirement tables for those in and out of the Deferred Retirement Option Program (DROP) and for those in DROP, different retirement tables for members entering DROP after July 1, 2013. This is a sound method because individuals have much different retirement patterns when DROP is involved. We would recommend that the experience study also distinguish between pre-DROP and post-DROP retirement rates. However, because of 2013 changes to DROP provisions, this data would not yet be relevant and credible.

Buck also assumes that 90% of those who do not retire when first eligible elect to enter DROP. No data was provided in the experience study presentation to support this assumption. We recommend that Buck include this important assumption in its experience study.

Finally, we noted that the Health valuation does not distinguish retirement tables between members entering DROP pre-July 1, 2013 and post-July 1, 2013 as in the Pension valuation. We recommend Buck adopt these tables for the next Health valuation.

Disability Retirement

Disability rates have continued to fall for both police and firefighters. Buck has proposed to reduce the assumed disability incidence further. We concur that the disability tables used by Buck are reasonable, consistent and accurate.

The disability assumption also includes a component as to type of disability (Permanent and Total, Partial On-Duty, and Off-Duty). Recent experience has shown that fewer disabilities are Partial and Total than expected, while more are Off-Duty than expected. As a result of this, Buck modified its assumptions somewhat. While we may have made slightly different modifications, we find that the disability-type assumption is reasonable, consistent and accurate.

Other Demographic Assumptions

We reviewed the other demographic assumptions which could be analyzed by Buck. We find their study reasonable, consistent and accurate. These assumptions include:

Marriage Rates – Buck assumes 75% of future retirees would be married. Current retirees use actual marriage data at the time of valuation. We support this approach. Buck offered no specific support for this assumption in its experience study report other than to indicate that “Data of new retirees from 2012 to 2016 suggests that 75% is still reasonable.” We recommend that this be included more explicitly in the formal report.

Age Difference between Husbands and Wives – Buck assumes husbands are 3 years older than wives. We find Buck’s analysis reasonable. Three years is a widely established norm. But given the large volume of OP&F data available, we recommend that Buck make some effort to demonstrate support for this assumption rather than merely rely on anecdotal norms.

Number of Dependents – Buck assumes that members have two dependent children born when the member was 26, and whose dependency will end at age 22. This was not explicitly mentioned in the experience study presentation, but seems very reasonable. We recommend that this be analyzed explicitly. The Health valuation states that children may be enrolled, generally until age 28, but does not explicitly state in the assumptions the age when dependency ceases. We recommend that the assumption for the age when dependency ceases be consistent between Pension and Health.

Annuity Option Selection – The Buck experience study indicated that the assumption that 33% of service retirees and 10% of disability retirees will elect a J&S pension is still reasonable. The assumed average of a 50% benefit to the joint annuitant is to be changed to 40%, based on recent experience. While we find these assumptions reasonable, and their significance is only modest, we recommend that Buck explicitly report the findings of the experience study which support these decisions.

Retirement Age for Inactive Vested Participants – Buck assumes that these members elect to retire at the later of age 48 and the completion of 25 years of service. This was not explicitly mentioned in the experience study presentation, but seems reasonable. We recommend that this be analyzed explicitly in the next experience study.

ECONOMIC ASSUMPTIONS

Investment Return Rate

Buck recommends a decrease from 8.25% to 8.00% for the investment return rate. This assumption change is consistent with rates used by most systems. Wilshire Associates reports that the median assumption is 7.50%. According to the Public Funds Survey as of December, 2016, the median assumption for 152 large primarily state systems is also 7.50%. In particular:

- 122 of the 152 (80%) use assumptions lower than 8.00%,
- 52 (34%) use a 7.50% assumption, the most commonly used,
- 27 (18%) use an 8.00% assumption, and
- Only 3 (2%, including OP&F) use an assumption greater than 8.00%.

An 8.00% or 8.25% rate would still be the highest rate used by the statewide systems in Ohio. The other systems' expected rates are:

- School Employees Retirement System of Ohio – 7.50%
- State Teachers Retirement System of Ohio – 7.45%
- Ohio Public Employees Retirement System – 7.50%
- Ohio Highway Patrol Retirement System – 7.75%

Of course, a simple comparison of what other systems are using is helpful, but not a sufficient criteria for establishing an assumed rate of investment return.

Buck used a robust forward-looking “building block” method, where they developed an inflation assumption, a real return assumption and an assumption for expenses. Each of these components was calculated independently, then summed (net of expenses) to develop the net investment return assumption.

Their 8.00% net return assumption is comprised of 2.75% inflation plus 5.25% real return net of administrative expenses. Inflation is discussed in the section below, so we will focus on the real return component and the administrative expense component.

Real Rate of Investment Return – To calculate the assumed real rate of return, Buck used its GEMS® Economic Scenario Generator in its experience study combined with the OP&F target asset allocation policy. This resulted in a nominal rate of 8.00%, which fell between the 15 and 20-year time horizon median return. The assumed inflation rate of 2.75% was then subtracted to obtain a real rate of 5.25%.

Based on our experience, investment consultants continue to pare back their expectations for future returns. This is partially a consequence of continued low inflation expectations and short term fixed income rates, but can also be on a real return basis. Consequently, we would expect that it is likely that the next experience study would suggest another drop in nominal investment return, all other things being equal.

According to the Public Funds Survey as of December, 2016, the median real rate of return assumption for 144 large primarily state systems which disclosed this is 4.50%. Although not specifically asked, this is presumably after reduction for administrative expenses in most responses. In particular:

- 38 of the 144 (26%) use assumptions lower than 4.50%,
- 33 (23%) use a 4.50% assumption, the most common assumption,
- 73 (51%) use an assumption greater than 4.50%, and
- Only 7 of the systems use a real rate of return assumption higher than the 5.25% assumed by OP&F.

A 5.25% real rate would still be the highest rate used by the statewide systems in Ohio. The other systems' expected real rates of return are:

- School Employees Retirement System of Ohio – 4.50%
- State Teachers Retirement System of Ohio – 4.95%
- Ohio Public Employees Retirement System – 5.00%
- Ohio Highway Patrol Retirement System – 5.00%

Administrative Expenses – Buck simply incorporates OP&F anticipated administrative expenses into its valuation. The investment return rate is assumed to be net of administrative expenses. We found no documented support in the actuarial valuation or experience study for this critical assumption. We recommend that Buck research this and develop a more robust expense assumption.

Health Care Plan Rate of Investment Return – Buck uses a 4.25% investment return assumption for the healthcare valuation. Buck developed this using a weighting between the assumed return from plan assets (8.25% currently) and an estimated short-term return of 4.00% on employer assets. The weighting is based on the portion of the total contribution toward the Annual Required Contribution. We recommend that Buck document the support for the 4.00% return on employer assets in the quinquennial experience study. In particular, if the assumed inflation rate is decreasing by 0.50%, it would make sense that the return on employer assets would also decrease by 0.50%.

DROP Interest Crediting Rate – Buck analyzed a range of assumed bond yields and its model suggested reducing this rate from 4.50% to 4.00%. We find this reasonable, appropriate and accurate.

Inflation

We reviewed the confirmation of the 2.75% inflation rate developed by Buck. Buck developed this primarily by looking at its GEMS® Economic Scenario Generator in its experience study. Buck did not disclose detail as to how this was developed, but we find that the resulting 2.75% assumption is very reasonable. We anticipate that Buck also considered forward looking data such as the yields on inflation-indexed treasury bonds, and economist forecasts to the extent that they are not purely short term. The end result supports a reduction from the 3.00% - 3.50% range to the 2.50% - 3.00% range. As a result of the 2017 experience study, the recommended inflation assumption was reduced from 3.25% to 2.75%. Because of the continued low inflation environment, we support this assumption.

According to the Public Funds Survey as of December, 2016, the median inflation assumption for 144 large, primarily state, systems who reported their inflation rate is 3.00%. In particular:

- 61 of the 144 (42%) use assumptions lower than 3.00%,
- The most common assumption is 3.00%, which is used by 37 (26% of the total), and
- 47 (33%) use an assumption greater than 3.00%.

A 2.75% rate is also used by one other statewide system in Ohio. The other systems' expected inflation rates are:

- School Employees Retirement System of Ohio – 3.00%
- State Teachers Retirement System of Ohio – 2.50%
- Ohio Public Employees Retirement System – 2.50%
- Ohio Highway Patrol Retirement System – 2.75%

CPI-Based COLA Assumption – Buck analyzed a range of assumed inflation rates and its model suggested reducing the COLA assumption (for certain future retirees) from 2.6% to 2.2%. We find this reasonable, appropriate and accurate.

Wage Inflation

Buck proposes a real wage inflation, or payroll growth rate, of 0.50%. When added to 2.75% inflation, this results in a total payroll growth assumption of 3.25%. We find this to be reasonable, consistent and accurate. Buck did not provide support for this assumption in its experience study, but 0.50% is typical and reasonable in our opinion. As mentioned above, however, this wage inflation assumption is also used for the amortization policy. If the population continues to decline, this 3.25% assumption may no longer be appropriate.

Individual Salary Increases

Buck analyzed individual salary increase rates, and found the real increase rates to be appropriate and not needing to be change. Buck recommended decreasing the nominal salary growth rate assumptions by 0.50% at all years to reflect the reduction in assumed inflation. This is probably a reasonable change. They supported this through data comparing the nominal salary growth experienced with that expected. We believe, however, that it is important to analyze *real* (inflation-adjusted) salary growth. Inflation averaged only 1.36% during the five-year period, compared with a new assumed rate of 2.75%. With such a large disparity between 2.75% and 1.36%, it is possible that the gap between actual and expected nominal returns could suggest that an increase in real salary increases is required. We recommend that Buck expand its methodology in the next experience study to include real salary growth, not merely nominal salary growth.

POST-EMPLOYMENT HEALTHCARE ASSUMPTIONS

Gross Claim Rate Derivation

It is common practice for actuaries to project future claim costs by measuring past experience and adjusting it to reflect the effects of inflation and plan design. It is not well documented in the actuarial report how Buck set the expected claims costs.

Because retiree health care actuarial valuations are a more recent development than pension actuarial valuations, common actuarial practice is less robust in terms of disclosure of methods and assumptions. The Buck disclosure of health assumptions is consistent with general practice, but not as strong as their disclosure of pension assumptions or best practice.

Based on our review of certain calculations, we find that the health care claim cost assumption is reasonable. However, we recommend that this be more rigorously

documented either in an actuarial experience study for healthcare or through expanded disclosure in the actuarial reports or both.

In order to develop the core health care claims cost assumption, Buck took the following steps.

- Develop average costs for the self-insured medical and prescription drug plans based on claims experience and current enrollment
- Adjust the costs with trend and plan changes to arrive at a claims cost per member
- Apply age-based morbidity factors to the gross costs to arrive at the 2015 Age-Specific Monthly Gross Costs

We have reviewed the resulting gross rates and find them reasonable, appropriately calculated and accurate.

Health Care Cost Trend Rate

To properly measure future liabilities, actuaries apply trend rates (health inflation) to the base claim costs described above. Standard practice is to use prevailing national trend rates and grade down to an ultimate trend rate that is slightly higher than prevailing CPI rates. It is reasonable to alter these national rates by applying population-based credibility factors to the Plan's experience and using a blended set of trend rates. Buck disclosed the following with respect to the establishment of the trend assumption:

“The trend rate is the annual rate at which the cost of covered medical services is assumed to increase from the current year to the next year. The valuation reflects costs and premiums established for 2015 and 2016 for Non-Medicare, Non-AARP and Rx.

We find this approach reasonable and the trend rates which it produces reasonable. In addition, we recommend that Buck disclose rationale for the trend assumptions relating to AARP and Medicare Part B.

Morbidity

In a health insurance valuation, morbidity is sometimes defined as the difference in claims costs at different ages. Morbidity rates are also known as aging factors. They are used to transform average health cost assumptions to health care cost assumptions which vary by age and gender. Buck did not disclose in the valuation report what data was used for development of aging factors.

We encourage Buck to review these factors in the next experience investigation to the extent data is available. At the very least, we would recommend that the experience study report disclose the process used for choice of these aging factors. We reviewed the aging factors developed by Buck and found them appropriate.

Retiree – Paid Premiums

The true measure of a plan's liability is the difference between total claims costs and the amount that retirees contribute to offset those total costs. In developing the Plan's liability, Buck used the OP&F allowance percentage times the total claims cost. We reviewed the methodology used by Buck and found it appropriate.

Health Plan Participation Rates and Elections

Buck assumes that 60% of non-Medicare members eligible for retiree health benefits elect coverage and 90% of Medicare eligible members elect coverage. Buck also assumes 50% of non-Medicare members who elect coverage and 70% of Medicare members who elect coverage elect coverage for their spouses and children. Further, Buck assumes 88% in the Health valuation (and 90% in the Pension valuation) of future Medicare members will elect the Medicare Part B benefit and 75% of all non-Medicare members who waived coverage will elect coverage once they become Medicare eligible. No supporting documentation is provided for these assumptions.

We recommend that Buck perform a more rigorous analysis of these assumptions. Further, we recommend that the Medicare Part B assumption be consistent between the Pension valuation and the Health valuation.

DISCLOSURE OF ACTUARIAL ASSUMPTIONS AND METHODOLOGY

Buck's disclosure of the majority of actuarial assumptions (and methods) was robust. But because of the complexity of OP&F, it is necessary for Buck to make dozens of additional assumptions regarding arcane and/or barely-material plan provisions. Many of these were either undisclosed or not supported in writing.

Actuarial Standard of Practice (ASOP) No. 41 on Actuarial Communications states:

In the actuarial report, the actuary should state the actuarial findings, and identify the methods, procedures, assumptions, and data used by the actuary with sufficient clarity that another actuary qualified in the same practice area could make an objective appraisal of the reasonableness of the actuary's work as presented in the actuarial report.

For the most part, the actuarial valuation report and experience study report did provide this information. That is because the dozens of assumptions and methods which were not fully disclosed were nearly negligible. But several assumptions and methods did rise to the level of materiality and we believe should be more rigorously disclosed and supported.

If OP&F were ever to change actuaries from Buck, the new actuary might not be able to confirm the reasonableness of Buck calculations without the above information. Even in the amicable process

of an actuarial audit, the limited disclosure required some back-and-forth questions with Buck as to how specific assumptions and methods were applied.

Because much of our items of concern are nearly immaterial, we do not necessarily recommend that Buck expand the actuarial valuation report and experience study report to address the more arcane concerns. A better approach might be for Buck to provide OP&F with a supplemental methodology and assumption report documenting the dozens of assumptions and methods used which do not rise to the level required by ASOP 41. We are not aware of all of these, because they were not disclosed, but those which we were able to discover include:

Pension Valuation:

1. Disclose that members who become disabled while in DROP remain in DROP.
2. Disclose limitations in the census data for inactive members with respect to the hire date information and its impact on the stated valuation assumption of commencement at the later of age 48 and 25 years since the hire date.
3. Disclose support for three-year age difference assumption between males and females.
4. Clarification of justification for mortality set-backs for various members.
5. Justification for 75% marriage rate assumption.
6. Disclosure of capital market assumptions cited in experience study report.
7. Disclose assumption for members withdrawing their contributions.
8. Disclose assumption for disability benefits.

Health Care Valuation:

1. Disclose in Benefit Provisions that Spouses' benefits revert to a Benefit Recipient upon the death of the retiree.
2. Disclose in Assumptions that liabilities are developed for the youngest child for current retirees.
3. Provide greater detail on the development of the Age-Specific Monthly Gross Costs for Benefit Recipients, Spouses and Children.

4. Disclose the States in which AARP/UHC does not vary its premium rates by length of Medicare Part B coverage at initial enrollment.
5. Disclose support for plan participation rates and elections.
6. Disclose the eligibility criteria for current benefit recipients, spouses and children for the various healthcare benefits.
7. Disclose the assumption regarding valuation of future children's benefits, including age at which dependency ceases.
8. Disclose assumption that Non-AARP covered retirees under 65 switch to AARP at 65 and Non-AARP covered retirees 65 and older remain covered under Non-AARP.
9. Disclose more robust rationale for the health care cost trend rates.

Disclose any other of the items discussed in Section 2 above that Buck believes are important enough to be disclosed in the actuarial report rather than the experience study or supplemental report.

Section 3 – Audit of Compilation of Actuarial Valuations

The cornerstone of an actuarial audit is a replication of the actuarial valuation. As mentioned above, we matched quite closely the costs and liabilities developed by Buck for the retirement system. Consequently, we conclude that the valuation results are reasonable, accurate and consistent.

The following table summarizes the present value of future benefits, actuarial liability and normal cost for the Pension Benefits produced by Buck and PTA/KMS actuarial valuations.

Table 3.1
Pension Benefits Liabilities as of January 1, 2015

Actuarial Liabilities and Normal Cost as of January 1, 2015 (\$ in thousands)			
	<u>Buck</u>	<u>PTA/KMS</u>	<u>% Diff.</u>
TOTAL			
Present Value of Future Benefits			
Active Members	11,204,175	10,876,870	-2.92%
Vested Former Members	30,971	30,788	-0.59%
Rehired Retirees	12,083	12,083	0.00%
Retirees and Disableds	9,519,905	9,353,803	-1.74%
Beneficiaries and Survivors	675,060	679,299	0.63%
Contributions Refund Due	28,180	27,641	-1.91%
Total	21,470,374	20,980,485	-2.28%
Accrued Liability			
Active Members	8,148,843	7,834,193	-3.86%
Vested Former Members	30,971	30,788	-0.59%
Rehired Retirees	12,083	12,083	0.00%
Retirees and Disableds	9,519,905	9,353,803	-1.74%
Beneficiaries and Survivors	675,060	679,299	0.63%
Contributions Refund Due	28,180	27,641	-1.91%
Total	18,415,042	17,937,808	-2.59%
Normal Cost	332,805	324,053	-2.63%

Note -- Rehired Retirees were not separately identified in the Pension census data; Buck provided the additional liabilities for this group, based on the account balances provided to Buck by OP&F. Buck liabilities were approximately \$12 million, less than 0.1% of the total.

The following table summarizes the actuarial liability and normal cost for the Retiree Health Benefits produced by Buck and PTA/KMS actuarial valuations.

**Table 3.2
Retiree Health Benefits Liabilities as of January 1, 2015**

Actuarial Liabilities and Normal Cost as of January 1, 2015 (\$ in thousands)			
	<u>Buck</u>	<u>PTA/KMS</u>	<u>% Diff.</u>
Present Value of Future Benefits			
Active Members	5,670,343	5,660,397	-0.18%
Inactive Members	35,103	34,059	-2.97%
Retirees, Spouses and Beneficiaries	2,516,093	2,379,129	-5.44%
Total	8,221,539	8,073,585	-1.80%
Accrued Liability			
Active Members	2,848,354	2,778,569	-2.45%
Inactive Members	35,103	34,059	-2.97%
Retirees, Spouses and Beneficiaries	2,516,093	2,379,129	-5.44%
Total	5,399,550	5,191,757	-3.85%
Normal Cost	216,966	212,015	-2.28%

Summary of Deviation of Results

	Pension Benefits Valuation Results	Retiree Health Valuation Results
Accrued Liability	-2.59%	-3.85%
Normal Cost	-2.63%	-2.28%

Actuaries generally use a 5% deviation as an acceptable range of error. As the total actuarial liabilities and normal costs deviations calculated by PTA/KMS were well within this “margin of error”, we are quite satisfied that numbers are appropriate.

Although we did match quite closely, there are several areas which we would encourage Buck to explore further:

- In valuing the Pension and Retiree Health benefits, the following are a few items we uncovered that could be corrected, but overall would be immaterial to the valuation results:
 1. In developing the Spouse Statutory Benefit, apply COLA increase of 3%, capped at the amounts disclosed in the valuation report, for all retirees regardless of pension COLA method provided in the data.

2. Apply a Medicare Part B reimbursement assumption of 88% for members assumed to be eligible for reimbursement once they reach age 65 for consistency with Health Benefits valuation.
3. Include service-related retirement rates to distinguish between benefits available at termination and benefits available at retirement. For example, a member may terminate at age 48 under a Service Commuted retirement with payments commencing at the later of age 48 and 25 years from hire date, but requires 15 years of service. Retirement rates at age 48 are 10%, however, the rates presumably do not apply here but termination rates do.
4. Apply different retirement rates for members entering DROP after July 1, 2013 in the Retiree Health valuation to be consistent with the Pension valuation.

OP&F provided us with the System data for all active members and pensioners. Detailed data layouts that identified all the data elements used by Buck were provided for the Pension valuation. Buck also provided us with the data files they utilized in performing the valuations. In performing our replication, we utilized the data files provided by Buck.

The following tables summarize the demographic statistics for the Pension Benefits and Retiree Health Benefits valuations produced by Buck and PTA/KMS actuarial valuations.

**Table 3.3
Active Members as of January 1, 2015**

POLICE	Male			Female			Total		
	Buck	PTA/KMS	% Diff.	Buck	PTA/KMS	% Diff.	Buck	PTA/KMS	% Diff.
Number of Members	13,420	13,420	0.00%	1,378	1,378	0.00%	14,798	14,798	0.00%
Annual Salaries	941,758,933	941,758,933	0.00%	94,595,736	94,595,736	0.00%	1,036,354,669	1,036,354,669	0.00%
Average Annual Salary	70,176	70,176	0.00%	68,647	68,647	0.00%	70,033	70,033	0.00%
Average Age	42.2	42.2	0.00%	42.7	42.7	0.00%	42.2	42.2	0.00%
Average Service	14.9	14.9	0.00%	14.9	14.9	0.00%	14.9	14.9	0.00%

FIREFIGHTERS	Male			Female			Total		
	Buck	PTA/KMS	% Diff.	Buck	PTA/KMS	% Diff.	Buck	PTA/KMS	% Diff.
Number of Members	12,456	12,456	0.00%	348	348	0.00%	12,804	12,804	0.00%
Annual Salaries	888,775,357	888,775,357	0.00%	23,223,537	23,223,538	0.00%	911,998,894	911,998,894	0.00%
Average Annual Salary	71,353	71,353	0.00%	66,734	66,734	0.00%	71,228	71,228	0.00%
Average Age	43.0	43.1	0.23%	41.6	41.6	0.00%	42.9	43	0.23%
Average Service	15.6	15.6	0.00%	12.9	12.8	-0.78%	15.3	15.3	0.00%

TOTAL	Male			Female			Female		
	Buck	PTA/KMS	% Diff.	Buck	PTA/KMS	% Diff.	Buck	PTA/KMS	% Diff.
Number of Members	25,876	25,876	0.00%	1,726	1,726	0.00%	27,602	27,602	0.00%
Annual Salaries	1,830,534,290	1,830,534,290	0.00%	117,819,273	117,819,273	0.00%	1,948,353,563	1,948,353,563	0.00%
Average Annual Salary	70,743	70,743	0.00%	68,261	68,261	0.00%	70,587	70,587	0.00%
Average Age	42.6	42.6	0.11%	42.5	42.5	0.00%	42.5	42.6	0.11%
Average Service	15.2	15.2	0.00%	14.5	14.5	-0.14%	15.1	15.1	0.00%

**Table 3.4
Inactive Members as of January 1, 2015**

POLICE	Male			Female			Total		
	Buck	PTA/KMS	% Diff.	Buck	PTA/KMS	% Diff.	Buck	PTA/KMS	% Diff.
Eligible for Allowances	105	105	0.00%	7	7	0.00%	112	112	0.00%
Eligible for Refunds Only	2,031	2,031	0.00%	322	322	0.00%	2,353	2,353	0.00%
Total	2,136	2,136	0.00%	329	329	0.00%	2,465	2,465	0.00%

FIREFIGHTERS	Male			Female			Total		
	Buck	PTA/KMS	% Diff.	Buck	PTA/KMS	% Diff.	Buck	PTA/KMS	% Diff.
Eligible for Allowances	67	67	0.00%	1	1	0.00%	68	68	0.00%
Eligible for Refunds Only	596	596	0.00%	58	58	0.00%	654	654	0.00%
Total	663	663	0.00%	59	59	0.00%	722	722	0.00%

TOTAL	Male			Female			Total		
	Buck	PTA/KMS	% Diff.	Buck	PTA/KMS	% Diff.	Buck	PTA/KMS	% Diff.
Eligible for Allowances	172	172	0.00%	8	8	0.00%	180	180	0.00%
Eligible for Refunds Only	2,627	2,627	0.00%	380	380	0.00%	3,007	3,007	0.00%
Total	2,799	2,799	0.00%	388	388	0.00%	3,187	3,187	0.00%

**Table 3.5
Retirees and Beneficiaries as of January 1, 2015**

SERVICE RETIREES	Police			Firefighters			Total		
	Buck	PTA/KMS	% Diff.	Buck	PTA/KMS	% Diff.	Buck	PTA/KMS	% Diff.
Number of Members	7,842	7,842	0.00%	5,972	5,972	0.00%	13,814	13,814	0.00%
Annual Allowance	348,564,651	348,564,651	0.00%	261,888,511	261,888,511	0.00%	610,453,162	610,453,163	0.00%
Average Allowance	44,448	44,448	0.00%	43,853	43,853	0.00%	44,191	44,191	0.00%
Average Age	67.8	67.8	0.00%	69.0	69.0	0.00%	68.3	68.3	0.00%

Actuarial Audit of Ohio Police and Fire Pension Fund (OP&F)

DISABILITY RETIREES	Police			Firefighters			Total		
	<u>Buck</u>	<u>PTA/KMS</u>	<u>% Diff.</u>	<u>Buck</u>	<u>PTA/KMS</u>	<u>% Diff.</u>	<u>Buck</u>	<u>PTA/KMS</u>	<u>% Diff.</u>
Number of Members	3,784	3,784	0.00%	2,576	2,576	0.00%	6,360	6,360	0.00%
Annual Allowance	140,778,964	140,778,964	0.00%	99,892,505	99,892,505	0.00%	240,671,469	240,671,469	0.00%
Average Allowance	37,204	37,204	0.00%	38,778	38,778	0.00%	37,841	37,841	0.00%
Average Age	61.8	61.9	0.16%	64.0	64.0	0.00%	62.8	62.8	0.00%

SURVIVORS & BENES	Police			Firefighters			Total		
	<u>Buck</u>	<u>PTA/KMS</u>	<u>% Diff.</u>	<u>Buck</u>	<u>PTA/KMS</u>	<u>% Diff.</u>	<u>Buck</u>	<u>PTA/KMS</u>	<u>% Diff.</u>
Number of Members	4,403	4,403	0.00%	3,386	3,386	0.00%	7,789	7,789	0.00%
Annual Allowance	45,392,789	45,392,790	0.00%	34,658,596	34,658,595	0.00%	80,051,385	80,051,385	0.00%
Average Allowance	10,310	10,310	0.00%	10,236	10,236	0.00%	10,277	10,277	0.00%
Average Age	71.0	71.1	0.14%	73.5	73.5	0.00%	72.1	72.1	0.00%

TOTAL	Police			Firefighters			Total		
	<u>Buck</u>	<u>PTA/KMS</u>	<u>% Diff.</u>	<u>Buck</u>	<u>PTA/KMS</u>	<u>% Diff.</u>	<u>Buck</u>	<u>PTA/KMS</u>	<u>% Diff.</u>
Number of Members	16,029	16,029	0.00%	11,934	11,934	0.00%	27,963	27,963	0.00%
Annual Allowance	534,736,404	534,736,405	0.00%	396,439,612	396,439,612	0.00%	931,176,016	931,176,017	0.00%
Average Allowance	33,361	33,361	0.00%	33,219	33,219	0.00%	33,300	33,300	0.00%
Average Age	67.3	67.3	0.00%	69.2	69.2	0.00%	68.1	68.1	0.00%

Section 4 – Other Considerations

ACTUARIAL REPORT

For the most part, we found the Buck actuarial valuation reports and experience study reports to be well written, and focusing on important issues. Actuarial Standard of Practice (ASOP) No. 41 provides extensive guidance to actuaries regarding actuarial communications. We find that the Buck reports generally comply with the guidance of ASOP 41.

We would recommend a few modifications to enhance the completeness of the actuarial valuation reports. These include items discussed in Section 3 as well as the following:

- We recommend that Buck include the following in the Pension Benefits and Retiree Health Benefits valuation reports:
 - Rationale for economic and demographic assumptions under the guidance of ASOP 27 and ASOP 35, respectively.
 - breakout of liabilities by pre-65 and post-65 health care benefits.

Additionally, the reports generally are consistent with Government Finance Officers' guidelines for reporting. The Buck signers of the reports are qualified actuaries.

The actuarial experience study and report were similarly comprehensive, complete and clear.

ACTUARIAL AUDIT PROCESS

Buck, unlike most actuaries at this time, we believe, has a policy which does not permit sharing of detailed individual calculations supporting the calculations reported in the actuarial valuation report. We have performed more than a dozen actuarial audits of public pension systems over the past two decades. In the vast majority of the cases, the actuary provides detailed calculations for a few select individuals. These detailed calculations provide hundreds of individually specific data-points which make it fully transparent exactly how calculations are being performed. This full transparency makes it possible for the auditing actuary to understand the precise calculations.

In the case of OP&F and Buck, rather than providing hundreds of detailed numbers for specified individuals, only twelve numbers are provided. This means that rather than reviewing the actuaries work, the auditing actuary must try to replicate the number without any specific information other than written descriptions in the report and statute. Buck tried to accommodate this obstacle by reviewing our calculations (we do not have such a no-sharing policy) in some instances and identifying differences. But as a consequence of this lack of information, (1) we cannot confirm that Buck is properly making the calculations, only that our calculations match within a reasonable

margin, and (2) the audit process is much more tedious, time-consuming and drawn out than normally.

We understand that there may be sound business, competitive or legal reasons for Buck to have this non-disclosure policy. We also understand that at some other major actuarial firms (some of which do not consult to public pensions) have a similar policy. However, it is important to point out that this policy makes actuarial audits much more problematic, lengthy and dubious than normal, as indicated in the previous paragraph. It would probably be helpful if future auditors were aware of the limits on shared information in advance.

These limits on audit disclosures plus the dozens of nuances in the assumptions and methodologies which are not currently disclosed make OP&F very dependent on Buck. This could be problematic should OP&F at some point choose to use a different actuary. We believe that a supplemental report to OP&F (which could be shared with future auditors) would alleviate this risk.

CONCLUSIONS

We found Buck's work to be strong. It was reasonable, consistent and accurate. We do not believe that any methods, assumptions, or calculations are erroneous to the level of necessary recalculations.

As indicated above, our primary recommendations are:

- Clarify certain language in the actuarial valuation reports
- Document the development of health care claim costs more rigorously either in the actuarial reports or in the experience study or both
- Examine several actuarial assumptions (discussed above) more rigorously in the next experience study
- Correct minor discrepancies in the next actuarial valuation
- Alert future auditors of the limits in disclosure

Buck, the ORSC, and particularly the OP&F staff were fully cooperative and responsive, which assisted in the process. Finally, we wish to reaffirm that the work done by Buck was reasonable, consistent and accurate.

Appendix A – Group Results

The following tables summarize the actuarial liability and normal cost for the Pension Benefits for each group produced by Buck and PTA/KMS actuarial valuations.

**Table A-1
Pension Benefits Liabilities**

Actuarial Liabilities and Normal Cost as of January 1, 2015 (\$ in thousands)			
POLICE	<u>Buck</u>	<u>PTA/KMS</u>	<u>% Diff.</u>
Present Value of Future Benefits			
Active Members	5,769,112	5,635,578	-2.31%
Vested Former Members	19,270	19,151	-0.62%
Rehired Retirees	8,250	8,250	0.00%
Retirees and Disableds	5,463,145	5,370,696	-1.69%
Beneficiaries and Survivors	394,001	396,522	0.64%
Contributions Refund Due	20,639	20,180	-2.23%
Total	11,674,417	11,450,377	-1.92%
Accrued Liability			
Active Members	4,189,098	4,054,523	-3.21%
Vested Former Members	19,270	19,151	-0.62%
Rehired Retirees	8,250	8,250	0.00%
Retirees and Disableds	5,463,145	5,370,696	-1.69%
Beneficiaries and Survivors	394,001	396,522	0.64%
Contributions Refund Due	20,639	20,180	-2.23%
Total	10,094,403	9,869,322	-2.23%
Normal Cost	175,972	171,160	-2.73%

Actuarial Liabilities and Normal Cost as of January 1, 2015 (\$ in thousands)			
FIRE	<u>Buck</u>	<u>PTA/KMS</u>	<u>% Diff.</u>
Present Value of Future Benefits			
Active Members	5,435,063	5,241,291	-3.57%
Vested Former Members	11,701	11,637	-0.55%
Rehired Retirees	3,833	3,833	0.00%
Retirees and Disableds	4,056,760	3,983,108	-1.82%
Beneficiaries and Survivors	281,059	282,777	0.61%
Contributions Refund Due	7,541	7,462	-1.05%
Total	9,795,957	9,530,107	-2.71%
Accrued Liability			
Active Members	3,959,745	3,779,670	-4.55%
Vested Former Members	11,701	11,637	-0.55%
Rehired Retirees	3,833	3,833	0.00%
Retirees and Disableds	4,056,760	3,983,108	-1.82%
Beneficiaries and Survivors	281,059	282,777	0.61%
Contributions Refund Due	7,541	7,462	-1.05%
Total	8,320,639	8,068,486	-3.03%
Normal Cost	156,833	152,893	-2.51%