

July 2005

Colorado Public Employees' Retirement Association

Actuarial Review As of December 31, 2004

MERCER
Human Resource Consulting



MERCER

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July 13, 2005

The Board of Trustees
Public Employees'
Retirement Association of Colorado
Denver, Colorado

Subject:
Actuarial Review

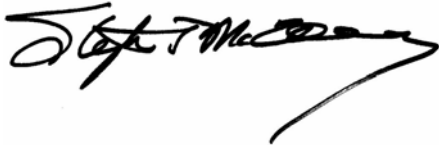
Dear Board Members:

Our findings and comments resulting from a detailed review of the December 31, 2004 actuarial valuation of the Colorado Public Employees' Retirement Association (PERA) performed by Buck Consultants are presented in the enclosed report.

This report includes a detailed discussion of all of the elements of our review. These issues are summarized in the Executive Summary. More detailed commentary on our review process and suggested considerations for refinements in actuarial procedures or presentations are included in subsequent sections of this report.

We wish to express our appreciation for the cooperation provided to us during the course of our work by the PERA staff as well as the actuaries at Buck Consultants.

Sincerely,



Stephen T. McElhaney, FSA



Deborah K. Distler, FSA

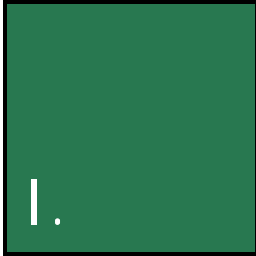
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Enclosure

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Executive Summary

Colorado Public Employees' Retirement Association (PERA) engaged Mercer Human Resource Consulting (Mercer) to review the December 31, 2004 actuarial valuation conducted by Buck Consultants (Buck). The purpose of the review is to have an independent actuary review the valuation to ensure that it is performed and reported in conformance with applicable actuarial standards of practice. The purpose is also to identify any changes in assumptions, methods or communications that, in our opinion, would improve the quality of the actuarial valuation and the understanding of its intended audience.

An actuarial valuation is completed to determine the required employer contribution rates each year, to produce an appropriate pattern of contributions to fund the plan's benefits over time, and to determine the plan's funded status. The valuation report is prepared to communicate the actuary's professional conclusions and recommendations, to record and communicate the methods and procedures, and to ensure that the parties addressed are aware of the significance of the actuary's opinion or findings.

It is important to understand that the actuarial valuation does not determine the actual cost of the benefits, but only the pattern of contributions. The actual cost of benefits is determined by PERA's benefit structure.

Statement of Key Findings

Based upon a thorough review of the December 31, 2004 actuarial valuation, we believe that the results as presented in the valuation report are reasonable, have been performed in accordance with generally accepted actuarial principles and practices, and were performed by fully qualified actuaries.

Actuarial Review Comments

It is important to understand that in selecting and recommending actuarial methods and assumptions, there is a great deal of professional judgment involved. In making the above Statement of Key Findings, we have not attempted to substitute our judgment for that of the consulting actuary to PERA. However, as a part of our review, we have identified a number of areas where PERA and its consulting actuary should undertake further investigation or study. These areas are described in each of the sections that follow this Executive Summary and are summarized below.

Actuarial Cost Method:

- Amortization method: The current amortization method is an open 40-year period with the amortization amounts calculated as a level percent of pay. This method is not designed to pay off the unfunded actuarial accrued liability and therefore defers costs to future generations of taxpayers and/or members.

Actuarial Asset Method:

- Transition amount: We were unable to reproduce the current adjustment for the difference in book and market values at December 31, 1992. We also recommend shortening of the period for fully recognizing the transition amounts.

Actuarial Assumptions and Experience Study:

- Inflation: We believe that the inflation assumption of 3.75% should be lowered to around 3.0%. With this change would come a corresponding decrease in the assumed payroll increase assumption, which is currently 4.50%.
- Investment return rate: The data presented suggests that the current assumption of 8.50% is aggressive. While the assumption falls within a reasonable range for actuarial valuation purposes, PERA should consider whether such rate should be decreased.
- Salary increases: The experience rates of salary increase related to merit and seniority for the School Division exceeded the assumed rates, and therefore the current salary increase assumptions for this division may be understated.
- Disability incidence: Actual disability rates during 2001-2004 were substantially less than the assumed rates for all groups and require further analysis.
- Maximum benefit limitations: We believe that the valuation calculations should not apply the maximum benefit limitations specified under Section 415 of the Internal Revenue Code since PERA provides benefits in excess of these limitations through a 415(m) plan.

Actuarial Report:

- Summary of Actuarial Assumptions: There are a number of actuarial assumptions being used that are not listed in the summary.
- Participant data: We recommend that additional participant data information be shown in the report.

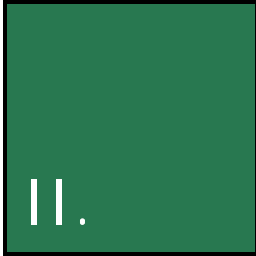
Valuation Results:

- Pay used for valuation calculations: Buck uses pay from one month (i.e., the December prior to the valuation date) to perform valuation calculations. There are a number of individual situations we found where results were distorted due to using just one month of pay. While these distortions do not materially affect the overall valuation results, we recommend that alternatives be considered.
- Data editing: We found several data issues which suggest additional edits of the data prior to completing the valuation would have been beneficial.
- Plan provisions: There are a number of plan provisions which are not being considered by Buck in the valuation. While the effect of these is likely not material, the valuation report should indicate where this is being done and whether the effect of considering would be material. These plan provisions include:
 - Pay increase limitations: PERA provides that annual pay increases that exceed 15% within the HAS period are not recognized for plan purposes. Buck does not apply this limit in its valuation calculations.
 - IRC 401(a)(17) limits: Section 401(a)(17) of the Internal Revenue Code provides for limitations on the maximum pay that can be used to compute benefits in a qualified retirement plan. Due to grandfathering provisions, this limit does not apply to pre-1996 PERA members. However, Buck applies the limitation to all members in its valuation calculations.
 - Judicial minimum formula: Judges with service before July 1, 1973 are provided an additional minimum benefit formula which is not recognized in the valuation calculations for active judges.
- Health Care Trust Fund (HCTF): Buck uses a simplified method to value liabilities for terminated vested members which overstates the liability. However these liabilities are small and the effect is not material.

We were also asked to provide review and comment on two areas of concern to PERA other than related to the current actuarial valuation:

- An examination of the current actuarial condition and an assessment of the steps needed to maintain actuarial soundness over the long term.
- An assessment of the advantages and disadvantages of the possibility of using pension obligation bonds to pay off a portion of PERA unfunded liabilities.

Both of the issues are addressed in sections of this report following our comments on the current actuarial valuation.



Actuarial Cost Method

The actuarial cost method used by PERA is the Entry Age Normal Cost Method.

Use of the Entry Age Normal Method is extremely common for public employee retirement systems. In the *2004 Wilshire Report on State Retirement Systems*, more than 70% of the state retirement systems were using entry age normal. A primary characteristic of the method is that it funds each active member's benefit as a level percentage of pay over his working career. This feature correlates well with the idea that pensions are deferred pay and therefore should be funded as a percentage of current pay.

For purpose of calculating the actuarially required employer contribution rates for PERA, the unfunded actuarial accrued liability under the cost method is amortized as a level percentage of pay over 40 years and is re-amortized for a new 40-year period at each valuation date. While this amortization method complies with the requirements of GASB Statement No. 25, it raises two issues.

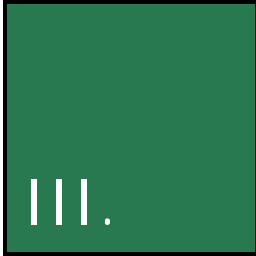
- 1) By amortizing the unfunded amount as a level percentage of pay, the amortization amounts in the early years are not sufficient to cover interest on the unfunded liability, meaning that the unfunded liability would increase even if the actuarially required contribution was made.
- 2) Since the unfunded liability is re-amortized over a new 40-year period at each valuation, even if contributions were made equal to the actuarially required rates, these contributions would never pay off the unfunded liability, even if all actuarial assumptions are exactly realized.

In one sense, using this amortization method understates the actual level of contributions which would be required to fund the unfunded actuarial liability and will cause the liability to be passed to future generations of Colorado taxpayers and/or members. However, these points are somewhat moot at the present time since the statutory contribution rates for all divisions are less than the actuarially required contribution rates.

It should also be noted that beginning in 2007, GASB requires a maximum amortization period not exceeding 30 years which will cause an increase in the actuarially required contributions. For example, for the State and School Division, the current total employer contribution rate of 16.91%, based on 40 year amortization of the unfunded liability, will increase to 18.59%, based on 30 year amortization of the unfunded liability.

In developing the Annual Required Contribution (ARC) under GASB Statement No. 25, Buck subtracts an amount identified as "Reduction for AED", which represents a leveling of the future employer contributions under the AED. It is our understanding that this methodology is used to develop a financing structure that distinguishes between the AED contributions and the regular employer contributions. While this approach may be reasonable in developing financing requirements, but it is consistent with the requirements of Statement No. 25, which generally recognizes employer contributions only when actually paid and would not distinguish between different statutory authorities for the contributions. A separate calculation will be needed in subsequent valuations for purposes of the GASB disclosures.

Notwithstanding these comments, the actuarial cost method meets applicable professional guidelines and we believe that it is appropriate for performing the PERA actuarial valuations.



Actuarial Asset Method

The actuarial asset valuation method calculates the actuarial value of assets that recognizes a smoothed market value of assets. Under the method, the difference between actual return on market value from investment experience and the expected return on actuarial value is recognized over a four year period. In addition, a transitional amount established in 1992 when the asset method was changed is being recognized over a 30 year period.

The use of a smoothing method removes volatility in investment experience and is very common for public retirement systems. In the *2004 Wilshire Report on State Retirement Systems*, more than 90% of the state retirement systems were apparently using some type of smoothing method. The major advantage of using a smoothing method is to remove volatility from the calculation of the actuarially required contribution, thus providing more predictability to budgets. The major disadvantage of smoothing is that it may provide an unrealistic view of the plan funded status as of a particular point in time.

While we believe that the use of smoothing in general and this specific method in particular are appropriate for PERA's actuarial valuations, we have two observations regarding the method:

- The amount smoothed each year is based upon the difference between the actual return on market value and expected return based on actuarial value. One criticism of this approach is that even under a scenario where the fund would earn the assumed asset return for all future years, the actuarial asset value and the market value would never become equal. A more common approach would be to calculate both the actual and expected returns based on market value.

- The 30-year period for recognizing the transitional amount is longer than commonly used for phasing in changes in an asset valuation method and we would recommend shortening or eliminating the remaining period. Also, we were unable to reproduce the 30-year amortization results from the book values and market values which existed on the transition date. Further investigation should be performed to determine whether the amounts currently being recognized are consistent with the original intent.

Notwithstanding these comments, the actuarial asset valuation method meets applicable professional guidelines and is appropriate for performing the PERA actuarial valuations.



Actuarial Assumptions and Experience Study

The current economic actuarial assumptions were adopted in 2003 based upon the advice of the actuary, Buck Consultants (formerly Mellon's Human Resources & Investor Solutions). The non-economic actuarial assumptions were adopted in 2001 upon the advice of the actuary at that time (Watson Wyatt Worldwide) based upon the results of an experience analysis.

Buck has recently performed an updated experience analysis of both the economic and non-economic assumptions covering period from 2001 through 2004. Our comments with regard to each assumption primarily cover the assumptions being recommended by Buck as a result of that more recent experience analysis.

It must be recognized in the setting of actuarial assumptions that there is not one answer that reflects the best estimate of future experience. Rather there is a best-estimate range, within which reasonable assumptions lie. We believe that all of the actuarial assumptions lie within this range. However, there are a number of areas in the analysis of actuarial assumptions where we have different opinions concerning the interpretation of the underlying experience data or different preferences with regard to the assumption selected. The comments below reflect these differing opinions or preferences.

Economic Assumptions

Investment return rate: The assumed investment return rate is 8.5%, which is the same rate used in the previous valuation. Prior to the December 31, 2003 actuarial valuation, the rate had been 8.75%. In the 2005 Experience Analysis, Buck has indicated that the rate is based upon a real rate of return of 4.75% with an assumed inflation rate of 3.75%.

In order to assess the reasonableness of this assumption we have used Mercer's proprietary Portfolio Return Calculator (PRC). The PRC uses as inputs the following information:

- Target asset allocation of the pension fund
- Annual expense of the fund expressed as a percentage of plan assets
- Capital market returns for each asset class as developed by Mercer Investment Consulting (MIC). These returns are expressed in nominal terms and also include measures of standard deviations from the expected value and correlations among asset classes. Capital market returns developed by other investment consulting firms can also be used in the PRC.

The output from PRC is a probability distribution of expected asset returns.

The following table shows the December 31, 2004 PERA asset allocation targets, the assumed nominal rates of return for each asset class as developed by MIC, and the assumed nominal rates of return developed by PERA's investment consultant, Ennis Knupp (EK):

Asset class	Allocation	MIC Return	EK Return
Domestic Equity	45%	8.16%	7.50%
Private Equity	8%	9.38%	10.00%
International Equity	14%	8.36%	7.20%
Fixed Income	25%	4.82%	5.60%
Real Estate	8%	7.27%	6.50%

For annual expense, we assumed 30 basis points, which is based upon 10 basis points for administrative expenses and 20 basis points for investment expenses. The administrative expense assumption is derived from PERA's own experience. The investment expense assumption is consistent with expenses associated with index returns. The implicit assumption is that any additional return from active management (alpha) is exactly offset by the additional expense for active management. To the extent that returns from active management exceed the additional cost, then such additional return should be added to the returns derived from the PRC. Using the above allocation and the assumptions as noted, the PRC produced the following expected investment returns over a 20 year investment horizon:

Percentile	MIC Assumptions	EK Assumptions
25%	5.66%	5.46%
40%	6.93%	6.63%
50%	7.70%	7.33%
60%	8.47%	8.04%
75%	9.75%	9.20%

Using MIC's assumptions, the median expected return would be 7.70%. The current assumption of 8.50% falls just outside the 60th percentile, meaning that we would conclude that there is less than a 40% probability that the assumed rate of return could be achieved. The Ennis Knupp results are slightly lower than MIC's.

The primary difference between our development of the expected return and Buck's development in the experience analysis would appear to be the inflation assumption. We would consider that a best estimate of the inflation assumption would be in the range of 2.5% to 3.0%. If Buck's inflation assumption were decreased to 3.0%, combined with their same real rate of return, their assumed rate of return under the "building block method" would be 7.75%, very close to the PRC's median rate of return of 7.70%.

Most surveys of large public retirement systems indicate an average investment return assumption of about 8.0%. For example, the *2004 Wilshire Report on State Retirement Systems* showed an average assumed investment rate of 7.99%. Therefore, PERA's 8.50% assumption is somewhat more aggressive than the average rate. The *Wilshire Report* also calculates an expected return for each state retirement fund based upon each fund's asset allocation. Wilshire's calculated expected return for PERA (before expenses) is 8.04%, which would be 7.74% net of expenses after subtracting the 30 basis point expense assumption used above. This result is very close to the 7.70% we derived using MIC assumptions. It should also be noted that Wilshire's average rate of return for all state pension systems was 7.17% (compared to PERA's 8.04% before expenses) indicating a more aggressive asset allocation for PERA compared to the average system.

Generally, Mercer considers that results between the 25th to 75th percentiles are within a reasonable range for the investment return assumption. The current assumption falls within this range whether we use the MIC, Ennis Knupp or Wilshire assumptions.

Payroll increases: The valuation assumes that total payroll for the system will increase at the rate of 4.50% for future years, which includes inflation at 3.75% and productivity increases of 0.75%. This assumption is used to determine the amount of amortization for the unfunded actuarial accrued liability. As mentioned in our comments regarding the investment return assumption, we believe that a more reasonable range for the inflation assumption would be from 2.5% to 3.0%. The effect of using a higher rate of future payroll increase causes the dollar amounts to increase at a greater rate and thereby lowers the amount of the unfunded liability amortization in the current year deferring greater amounts to later years.

Salary increases: The current salary increase assumptions are based upon an inflation and productivity assumption of 4.5% combined with merit and seniority increases which decrease with age. This approach is very typical for large public retirement systems.

In general, the 2001-2004 salary increases were substantially lower than the assumed increases. This result is likely due to lower inflation during this period than is assumed, which averaged about 2.3% compared to the assumed rate of 3.75%. Buck is recommending decreases in most of the salary increase rates, but not as much as the experience shows probably because of the differences in the actual versus the assumed inflation rates.

One exception to the general trend was for the School Division which experienced salary increases fairly close to the assumed rates. If the actual rate of inflation during this period was subtracted from the actual salary increases, the actual salary increases due to merit and seniority would be shown to exceed the assumed increases for these components. If we then add the actual merit and seniority increases to the assumed inflation rate of 3.75%, we would obtain a greater rate of total future salary increase for this group, indicating that the current assumption may be too low.

Given the substantial difference between assumed inflation and actual inflation during the period of analysis, it might be more helpful if the effects of inflation had been removed from the salary analysis and that actual merit and seniority increases were compared to assumed merit and seniority increases.

Notwithstanding these comments, we believe that the assumptions proposed by Buck for salary increases are reasonable for the PERA valuation.

Non-economic Assumptions

Mortality: PERA uses separate mortality tables for healthy and disabled retirees that are based upon system experience. Separate tables are used for males and females. Buck has proposed revisions in all tables as a result of the 2001-2004 system experience.

Generally, a mortality assumption is conservative if the experience is resulting in more deaths than assumed. An actual to expected ratio of about 110% to 120% is desirable in order to allow for future mortality improvements. Mortality experience less than 100% for retirees means that retirees are living longer than expected and that the current valuation results may be understating plan liabilities.

We compared the PERA experience tables for healthy retirees to two current standard mortality tables which are widely used, the 1994 Group Annuity Mortality Table (Static) and the RP2000 Combined Mortality Table. In general the PERA mortality tables for males have significantly higher mortality rates between ages 45 and 55, and lower mortality rates at most other ages. For females the mortality rates are close to the standard tables between ages 45 and 55 and lower at most other ages.

The experience mortality rates for healthy males during 2001-2004 are significantly lower than the assumed rates and produce an overall actual to expected ratio of 67%. Buck's proposed changes would generally reduce rates for healthy retirees by 10% which would still result in a ratio of less than 80%. If the experience of the current study period is expected to continue, these rates will need to be reduced further in the future which will increase plan liabilities. We believe that an even greater decrease in the mortality rates could be justified at this time, which would increase actuarial liabilities.

The experience rates for healthy females during 2001-2004 were greater than assumed and Buck is proposing an increase in female mortality rates. The proposed rates are still generally lower (and therefore more conservative) than the standard tables and we believe that the recommended table is reasonable.

The disabled retiree experience results are similar to the healthy retiree results which show lesser than expected mortality for males and greater than expected mortality for females. Buck is recommending some very small reductions in the male rates and increases in the female rates. Based on the experience results, we believe that greater reductions in the male rates could be justified.

Overall, the mortality rates being recommended would meet a reasonable standard for use in the actuarial valuation.

Withdrawal rates: The results of the 2001-2004 experience analysis study has generally indicated terminations occurring at a greater rate for all classes of members except for troopers. Accordingly, Buck has recommended increases in withdrawal rates for all classes except troopers and has recommended some decreases in rates for troopers.

We agree that all of these recommendations are reasonable.

Disability incidence: The 2001-2004 experience analysis shows substantially fewer disabilities than assumed. Disabilities in all categories of members, both for males and females, are less than 30% of assumed. Buck has recommended relatively minor adjustments in the rates to reflect lower disability incidence, but not anywhere near the 2001-2004 experience rates.

These results are in contrast to the prior experience analysis where actual disabilities were close to those assumed. The following are possible explanations for these results:

- Disability experience really has improved. If the reasons for this can be identified and if this is expected to continue, then the assumptions should be adjusted even lower to reflect this experience, which should result in a decrease in system liabilities.
- The experience during the study period was an anomaly and it is expected that future experience will track closer to the experience prior to 2001. In this instance, the Buck recommendations for changes are reasonable.

- There was a problem in processing experience data for disabilities and the results do not accurately reflect the actual experience.

Mercer recommends more analysis of these results prior to setting any assumptions.

Retirement rates: Currently there are separate retirement assumptions for each membership class, as well as separate assumptions for males and females except Troopers and Judicial. The assumptions vary by age but do not distinguish between whether the member is eligible for a reduced or unreduced retirement benefit. It is generally expected that members eligible for unreduced benefits will retire at greater numbers than those with reduced benefits. Buck has measured the experience separately for reduced and unreduced retirement benefits and has recommended separate tables be adopted. We have reviewed the experience and the recommendations and believe that the proposed assumptions are reasonable.

Percent electing a deferred retirement benefit: The valuation assumes that 35% of vested members who terminate will elect to withdraw their contributions and matching contributions while 65% elect to leave their contributions in the plan in order to be eligible for a benefit at normal retirement date (except Judicial). While this assumption seems reasonable, it was not included in the experience analysis. We recommend that this assumption be included within the next experience analysis to determine its reasonableness.

Assumptions Not Disclosed in Report

A number of assumptions which were used in the actuarial valuation were not disclosed in the valuation report. We believe that all of these should be included in the summary of actuarial assumptions. It might also be appropriate to address the reasonableness of these assumptions in the next experience study.

Survivor benefit assumptions: In order to value survivor benefits, assumptions must be made regarding percentage married, spouse's age, number of children and dependent parents.

Conversion rate for money purchase account: Assumptions are made regarding the value at which money purchase accounts are converted to annuity payments.

Increases in maximum compensation and maximum benefit limitations: An assumption is made regarding the annual rate of increase in these limits.

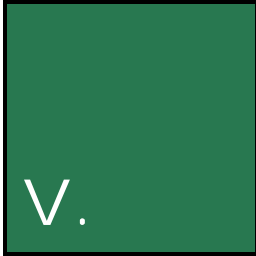
Maximum benefit limitation: Section 415 of the Internal Revenue Code limits the annual benefit paid to the lesser of 100% of average compensation or a dollar amount. The dollar amount in 2005 is \$170,000, which is reduced for payments commencing prior to age 62. The dollar limitation automatically increases each year with the CPI. Buck applies this limitation, including a 3.75% annual inflation assumption, to the benefits valued in the actuarial liabilities. However, PERA effectively funds benefits in excess of the Section 415 limitations through a Section 415(m) plan by reducing employer contributions dollar for dollar by amounts the employer pays to a retiree under the 415(m) plan. Therefore, we believe that it would be more appropriate for the valuation calculations to be done without regard to Section 415 limitations.

Other Assumptions for Postretirement Health Care Program

The post retirement health care program uses most of the same assumptions that are used for valuation of pension benefits. However, there are a few additional assumptions required.

Participation percent: Buck assumes that 55% of participants will elect coverage prior to age 65 and 75% will elect coverage after age 65. In addition they assume 30% of deferred vested members will elect coverage. We believe that these assumptions are reasonable.

“No Part A” Subsidy: For retirees over 65 and not participating in Medicare Part A, assumptions are required for expected claim rates and future cost trend increases. We have reviewed these assumptions and believe that they are reasonable.



Actuarial Report

The communication of actuarial valuation results for pension plans is covered in the Actuarial Standards Board (ASB) Standard of Practice No. 4, Measuring Pension Obligations. Generally, sufficient information should be presented such that:

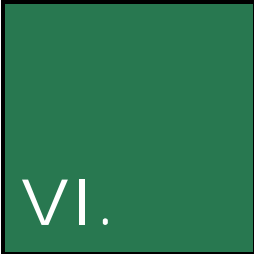
- it would be properly interpreted and applied by the person or persons to whom the communication is directed, and
- another actuary in pension practice could form an opinion about the reasonableness of the conclusion.

Standard of Practice No. 4 also indicates specific requirements for content of actuarial reports including:

- The name of the person or firm retaining the actuary and the purpose of the report
- An outline of the benefits being valued
- The effective date of the calculation
- A summary of participant data
- A summary of asset information
- A description of the actuarial methods and assumptions
- A statement of the findings, conclusions or recommendations necessary to satisfy the purpose of the communication

In a prior section of this report, we have noted several of the actuarial assumptions that are not listed within the actuarial valuation report and we have recommended their inclusion. Other than this exception, the actuarial valuation report meets all of the requirements of Standard of Practice No. 4. We offer the following suggestions which we believe would add to the clarity and completeness of the report:

- Very minimal participant data information is shown in the report. Many actuarial reports include distributions of members by age and service and a reconciliation of data from the prior year.
- Some context would be helpful around the subsidy analysis of the health care program shown on last page of the report to help the reader relate it to other information shown.



Valuation Results

Our review of the valuation results included the following:

- Reviewing the data editing procedures used to “clean” the valuation data provided by PERA;
- Checking of testcases provided by Buck to determine whether plan provisions and actuarial assumptions were programmed and applied properly;
- Comparing PERA calculated benefits for January, 2005 terminations and retirees to Buck’s calculations for the same individuals for the December 31, 2004 valuation; and
- Completing a parallel valuation of pension and HCTF liabilities using the same year-end data, funding method, and assumptions used by Buck.

Through these reviews we found several generally small issues. Although we recommend further review and discussion of some of the issues, none are significant enough to affect our opinion as to the reasonableness of valuation results.

Reviewing the data editing procedures used to "clean" the valuation data provided by PERA

We received from Buck a summary of their procedures for editing and preparing the data received from PERA for the valuation.

Due to the size of the plan membership and the required timing for the valuation results, Buck does not send data questions to PERA, but instead prepares listings of data inconsistencies they find in preparing the data for the valuation, along with their assumptions for handling the inconsistencies for PERA. Buck does not prepare a complete data reconciliation from the prior year's data to the current year's data.

Buck's methods for preparing the data for the valuation are typical of methods used for large public plans. Due to the size of the plan membership, addressing individual data questions and issues and fine tuning the data would take significant time and generally would not have any material impact on the valuation results. However, the lack of a complete data reconciliation from one year to the next could cause experience study results to be less reliable.

In addition, we did note the following data issues which would suggest some additional data edits and research would be recommended:

- The number of nonvested inactive members who are eligible to elect refunds in the report is extremely high (103,770 members total, 94,055 for the State and School Division, 9,712 for the Municipal Division and 3 for the Judicial Division). PERA should confirm this number is reasonable. If the number is accurate, then we recommend efforts be made to distribute the payouts as quickly as possible since it becomes harder to locate members the longer the payment is outstanding, and such a large number of outstanding payments complicates the data matching and editing process for the valuation.
- In matching the file from PERA containing actual benefits payable for members retiring in January, 2005, we noted that 15 of the 291 January retirees were not included in Buck's valuation data. It is our understanding that Buck treated these members as inactive with no benefits due, based on the members' status codes in the data PERA provided.
- In the valuation data that Buck provided, we noted that the pay for 2004 decreased from 2003 pay for over 70% of the active population. Upon further review of this issue, we compared the valuation data submitted by PERA to that used by Buck. Based on the valuation data and layouts provided, we believe that Buck switched 2003 and 2004 pay (i.e., input 2004 pay for 2003 and 2003 pay for 2004) for use in the valuation. Since Buck's valuation calculations are based primarily on the pay reported for December 2004, the impact of valuing these calendar pays in the correct years should be small, but should be verified by Buck.

- The December 2004 monthly rate of pay provided by PERA was negative for over 1,300 active members. The negative pay was included without revision on the valuation data we received from Buck. In exploring this issue with Buck, they confirmed their valuation system did not use the negative pay for these members but instead used an estimated average pay.

Checking testcases to determine whether plan provisions and assumptions were programmed properly

We requested from Buck testcases of inactive plan members with a wide range of benefit types, and testcases of active plan members with various age and service combinations. Testcases were received from all divisions (i.e., State and School Employees, Judicial and Municipal). For the testcases of active plan members, our review included checking the projected benefits for each member (known as “benefit arrays”) as well as a review of the actuarial present values computed from such benefit arrays. From our review we found the following issues:

Pay Used for Valuation

PERA provides calendar year 2003 and 2004 pay in addition to the monthly pay rate for December, 2004 to Buck for the valuation. Buck establishes projected pay for 2005 and beyond for each member based on the member’s December, 2004 monthly pay times 12. We found that use of this pay did not accurately correspond to the member’s prior calendar earnings in several cases. This is illustrated by the following examples:

Testcase with 30 years of service		Testcase with 35 years of service	
Projected pay for 2005	\$151,344	Projected pay for 2005	\$210,000
2004 pay	62,195	2004 pay	97,526
2003 pay	59,881	2003 pay	96,547

We found over 12,600 active members with two or more years of service whose calendar year pay was relatively constant or increasing from 2003 to 2004 and then increased by more than 25% from 2004 to 2005. The use of the higher than actual earnings for plan members causes plan liabilities to be overstated. The impact is amplified by Buck’s use of mid-year decrements and the resulting use of the 2005 pay twice in the Highest Average Salary (HAS) development for accrued benefits. Although the overstatement should be small relative to total plan liabilities (due to the small proportion of active members impacted (5.8%)), we recommend Buck explore with PERA alternative methods for calculating pay on which to base valuation projections. For example, the valuation could use pay from the 12-month period ending in December rather than just the one month.

Historical Pay

PERA's plan provides that the HAS be determined based on nonconsecutive calendar years of pay. PERA provides two years of historical pay with the valuation data. This may result in plan liabilities that are understated if a member's highest years of earnings are not within the last 2 years.

Pay Increase Limitations

PERA's plan provides that no annual pay increases greater than 15% are to be recognized in the HAS determination. Buck does not account for this limitation in their valuation. Therefore, the projected HAS and resulting benefit arrays for affected members are too high, resulting in liabilities that are overstated.

Decrement Coordination

In our review of the testcases for the Trooper division, we found overlapping withdrawal and retirement decrements (i.e., the decrements were both applied rather than one or the other). The benefit arrays did not overlap. This overlap results in liabilities for the Trooper division being understated. However, since this is a small active group (740 members), the impact on overall liabilities would not be significant.

401(a)(17) Limits

PERA's compensation definition excludes certain members from the IRC Section 401(a)(17) limitations. Buck is applying this limitation to all members, which results in pay and liabilities that are understated for these members. However, there are very few PERA members whose pay would be high enough to exceed the limitations.

Judicial Minimum Formula

PERA provides additional minimum benefit formulas for Judges prior to July 1, 1973. These additional formulas are disclosed in Buck's valuation report but are not being valued. The liabilities for the small group of members which are affected would be understated.

Liabilities for Members Over Age 70

In reviewing a Buck testcase for an active member over age 70 with few years of service, we noted that Buck's valuation system was not capturing any liability for this member. We found approximately 460 active members over age 70 with little or no service for whom it is likely that Buck is not capturing any liability. We found another 1,080 active members over age 70 who have 2 or more years of service. It is likely that Buck is not capturing the full liability for this group. Because this group accounts for less than 1% of the population, the impact on valuation results should be small, however, we recommend Buck quantify this number.

Liability for Terminated Vested Members

The liability for the terminated vested members is estimated as 185% of the current money purchase balance. We recommend Buck review this method for reasonableness.

Comparing PERA calculated benefits for January, 2005 terminations and retirees to Buck's calculations for the same individuals for the December 31, 2004 valuation

We requested from PERA a file of actual benefits payable for members terminating or retiring in January 2005 (shortly following the date of the actuarial valuation). We then requested testcases from Buck for some of these same members. We would normally expect to see the benefit in the testcase for the first year nearly identical to the actual benefit calculation. Although the service and account balance data were generally consistent, we found significant differences in the HAS used for some of the retirees. In addition, as noted earlier, 15 of the January, 2005 retirees on PERA's file were not included in Buck's valuation results. A summary of the benefit comparisons is provided on the next page.

Comparison of PERA Calculated Benefits for January 2005 Terminations and Retirees with Buck Testcases

Division	Service			HAS			Benefit			Account Balance			Type	Notes
	Buck	PERA	% Difference	Buck	PERA	% Difference	Buck	PERA	% Difference	Buck	PERA	% Difference		
Municipal	35.39	34.86	2%	150,468.42	96,387.84	56%	133,135.09	84,006.84	58%				Retirement	PERA pay significantly lower than expected
Municipal	31.50	31.25	1%	48,141.14	49,101.84	-2%	37,911.15	38,360.76	-1%				Retirement	
Municipal	30.33	29.83	2%	104,412.00	65,954.52	58%	79,178.88	49,190.64	61%				Retirement	PERA pay significantly lower than expected
Judicial	26.50	26.08	2%	111,682.04	110,392.08	1%	73,989.59	71,983.92	3%				Retirement	
State	12.00	11.62	3%	49,305.14	62,951.28	-22%	14,791.54	17,676.24	-16%				Retirement	PERA pay significantly higher than expected
State	35.67	35.33	1%	151,581.14	83,143.20	82%	135,159.86	73,442.52	84%				Retirement	PERA pay significantly lower than expected
School	6.92	6.42	8%	20,705.54	22,754.16	-9%	10,352.77	11,377.08	-9%				Disability Retirement	
Municipal	6.42	6.00	7%							22,349.74	20,741.44	8%	Termination	
State	6.00	5.57	8%							22,048.94	20,101.68	10%	Termination	
Municipal	3.00	2.57	17%							5,433.22	4,935.87	10%	Termination	
Judicial	8.75	8.33	5%							30,060.13	28,266.09	6%	Termination	
State	3.00	2.58	16%							5,944.62	5,126.98	16%	Termination	

- Buck assumes mid-year decrements, so the amounts shown from Buck are projected to mid-year. This accounts for some of the minor differences in service and account balances.
- We believe the significant differences in HAS and retirement benefits are primarily due to Buck’s use of December, 2004 pay for calculating earnings and benefits. The pay for this month may not be representative since it may include unusual items, such as bonuses or accrued leave, particularly in the month prior to retirement. As noted earlier, we recommend Buck explore alternative methods for calculating pay on which to base valuation projections.

Completing a parallel valuation of pension and HCTF liabilities using the same year-end data, funding method, and assumptions used by Buck

The charts below show the results of our parallel valuation as of December 31, 2004, using Buck data and assumptions.

Pension Results									
	State and School			Municipal			Judicial		
	Mercer	Buck	% Difference	Mercer	Buck	% Difference	Mercer	Buck	% Difference
Active Members									
Number	160,465	161,383	-0.57%	15,165	15,184	-0.13%	272	273	-0.37%
Payroll (000s)	5,300,197	5,303,439	-0.06%	549,488	549,607	-0.02%	26,207	26,309	-0.39%
Average Pay	33,030	32,862	0.51%	36,234	36,196	0.10%	96,349	96,370	-0.02%
Present Value of Future Benefits (000s)	23,984,398	24,337,281	-1.45%	2,175,653	2,202,842	-1.23%	132,782	133,153	-0.28%
Entry Age Accrued Liability (000s)	16,447,256	17,155,346	-4.13%	1,331,719	1,382,280	-3.66%	96,500	99,804	-3.31%
Retired Members and Beneficiaries									
Number	64,333	64,334	0.00%	3,323	3,323	0.00%	243	243	0.00%
Total Benefits (000s)	1,769,379	1,748,254	1.21%	83,143	81,994	1.40%	9,306	9,062	2.70%
Accrued Liability (000s)	22,365,818	22,629,338	-1.16%	1,093,055	1,097,449	-0.40%	103,841	107,171	-3.11%
Deferred Vested Members									
Number (including deferred Beneficiaries)	11,643	11,643	0.00%	889	889	0.00%	16	16	0.00%
Accrued Liability (000s; liability for deferred Beneficiaries included with Retirees)	806,676	806,676	0.00%	76,504	76,503	0.00%	2,823	2,823	0.00%
Members with Refunds Due									
Number	93,915	94,055	-0.15%	9,699	9,712	-0.13%	3	3	0.00%
Accrued Liability (000s)	192,243	192,171	0.04%	21,000	20,756	1.18%	156	156	0.00%

Postretirement Health Care Program Results			
	All Groups		
	Mercer	Buck	% Difference
Active Members			
Number	175,902	176,840	-0.53%
Present Value of Future Benefits (000s)	545,787	550,267	-0.81%
Entry Age Accrued Liability (000s)	436,106	431,223	1.13%
Deferred Vested Members			
Number	12,251	12,251	0.00%
Accrued Liability (000s)	8,582	18,801	-54.35%
Retired Members			
Number	38,795	38,795	0.00%
Accrued Liability (000s)	490,953	489,545	0.29%

We performed a parallel valuation with Buck to ensure that they were effectively valuing the provisions of the plan and applying the assumptions that they disclosed. Overall, Buck's liabilities matched up well to our liabilities. The differences in our total plan liabilities are reasonable. The present value of future benefits for each of the divisions was slightly lower than that calculated by Buck, but still within 1.5%. The total accrued liabilities were within 4.1% of Buck's accrued liabilities.

We believe one of the primary causes for the difference in our liabilities is due to the differences in our valuation systems, e.g., use of mid-year versus beginning of year decrements. Buck's valuation system utilizes mid-year decrements. Therefore, all pay and service values are projected by a half year from the valuation date. This differs from our valuation system which utilizes beginning of year decrements. There are valid arguments for each approach and both approaches are reasonable. In addition, the method used by Buck's valuation system to calculate HAS creates a higher HAS than produced by our system.

Another cause for the differences in our liabilities is the handling of members with negative pay.

In matching up PERA's inactive liabilities to those of Buck, we noted that the deferred beneficiaries were included with the deferred vested headcount but the liabilities were included with those of the retirees. We also included the liabilities for the deferred beneficiaries in order to make our numbers consistent with Buck's summaries.

Our HCTF liabilities matched up well with Buck's except for the liabilities for the terminated vested members. The difference for this group is due to the difference in our methodologies for valuing the liabilities. Our liabilities were calculated based on individual terminated vested member dates of birth and average service whereas Buck's liabilities were estimated based on average age and service for the entire population.

We have also reviewed Buck's calculations regarding the required contribution rates and the extent to which the current statutory contributions are sufficient to pay off the unfunded actuarial accrued liability. For each division, the amortization period for the unfunded liability is indicated as "infinite" meaning that the statutory contribution rates are not sufficient to pay off the unfunded liability over any period of time. Our overall conclusion in matching Buck's liabilities was that any differences between Mercer and Buck are primarily due to software differences and therefore we have accepted Buck's calculations as being reasonable and accurate for purposes of the valuation. Even if we substituted our valuation calculations for Buck's in this determination, the overall funded status of the system would not be materially changed and we would still compute an infinite amortization period for the unfunded actuarial accrued liability.

VII.

Actuarial Soundness

The State and School Division represents about 94% of the total actuarial accrued liability for pension benefits. In order to evaluate the PERA's actuarial soundness, we projected the liabilities and assets for this division over a 20 year period.

There is no universally accepted definition for actuarial soundness. However, it is generally agreed that an actuarially sound system should be structured such that benefits promised to plan members will be able to be met by plan assets. Characteristics of actuarially sound systems might be (a) funded ratios that are moving toward 100% and (b) actuarially required contributions that are relatively stable as a percentage of pay. The purpose of our projections is to provide projections of future funded ratios and future actuarially required contributions, to assist in determining the actuarial soundness of the system.

The projections are based on the following assumptions and methods:

- Liability interest rate remains at 8.5%
- New member demographic make-up (age, gender, pay) is assumed to be similar to patterns for those hired in last several years
- New entrant pay will increase by 4.5% each year
- All other assumptions (turnover, retirement, death, etc.) are the same as in December 31, 2004 Buck valuation; projections assume assumptions are realized each year
- Active plan membership remains constant
- Unfunded accrued liability (UAL) amortized over a rolling 40 year period
- Funded ratios are based on market value of assets (rather than smoothed assets)
- Benefits are valued pursuant to the PERA plan effective January 1, 2005, with plan changes effective July 1, 2005 for all new members
- Three assumed returns on assets are used, 7%, 8.5% and 10%. Therefore we are illustrating results if the assumed actuarial rate of return (i.e., 8.5%) is attained, as well as returns 1.5% above and below this rate.

- Deterministic projections were used (these are not intended to model the full range of possible outcomes).

The results are shown in the six graphs which are included at the end of this section. Our comments on these graphs are as follows:

Projected Plan Population

We have assumed that the current active membership of approximately 161,000 continues unchanged for all future years. As shown in the graph, as existing active members terminate employment they are replaced by new members to maintain the constant number.

Projected Payroll

Payroll of about \$5.3 billion in the current valuation is assumed to increase to about \$10 billion by 2025.

Projected Accrued Liability

The actuarial accrued liability of \$40.8 billion at December 31, 2004, is expected to increase to almost \$90 billion in 2025.

Projected Accrued Liability vs. Assets

Plan assets at December 31, 2004 were about \$30 billion on a market value basis. Projections are shown using three assumptions for future investment return and assume no changes in statutory contribution rates except for those already legislated:

- If asset returns are equal to the assumed rate of return of 8.5%, plan assets are expected to increase to about \$47 billion by 2025.
- If asset returns are equal to 10% per year over the next 20 years, plan assets would be expected to increase to about \$78 billion at the end of the period.
- If asset returns are equal to 7% per year over the next 20 years, plan assets would remain relatively level for about 11 years and then begin decreasing, reaching a level of about \$24 billion in 2025.

Projected Funded Ratios

This chart expresses the projected plan assets as a percentage of projected accrued liability:

- If asset returns are equal to the assumed rate of return of 8.5%, the funded ratio decreases from 74% at December 31, 2004, to 53% after 20 years.
- If asset returns are equal to 10% per year, the funded ratio will increase gradually to about 85% over the 20 year period.
- If asset returns are equal to 7% per year, the funded ratio will drop below 30% by 2025.

Contribution Requirements as a Percent of Payroll

We have projected the calculated employer plus employee contribution rate, assuming investment earnings at the assumed rate of 8.5%. It is assumed that the unfunded liability will continue to be amortized as an open 40 year period (i.e. re-amortized over a new 40-year period at each valuation date). This actuarially determined rate is compared to the statutory combined employer/employee rate including AED contributions. Based upon the December 31, 2004 actuarial valuation, this actuarially computed combined rate would be about 25% of pay (adjusted for using market value of assets rather than actuarial value of assets). This rate is expected to increase to over 35% of pay by the end of the 20-year period.

Observations

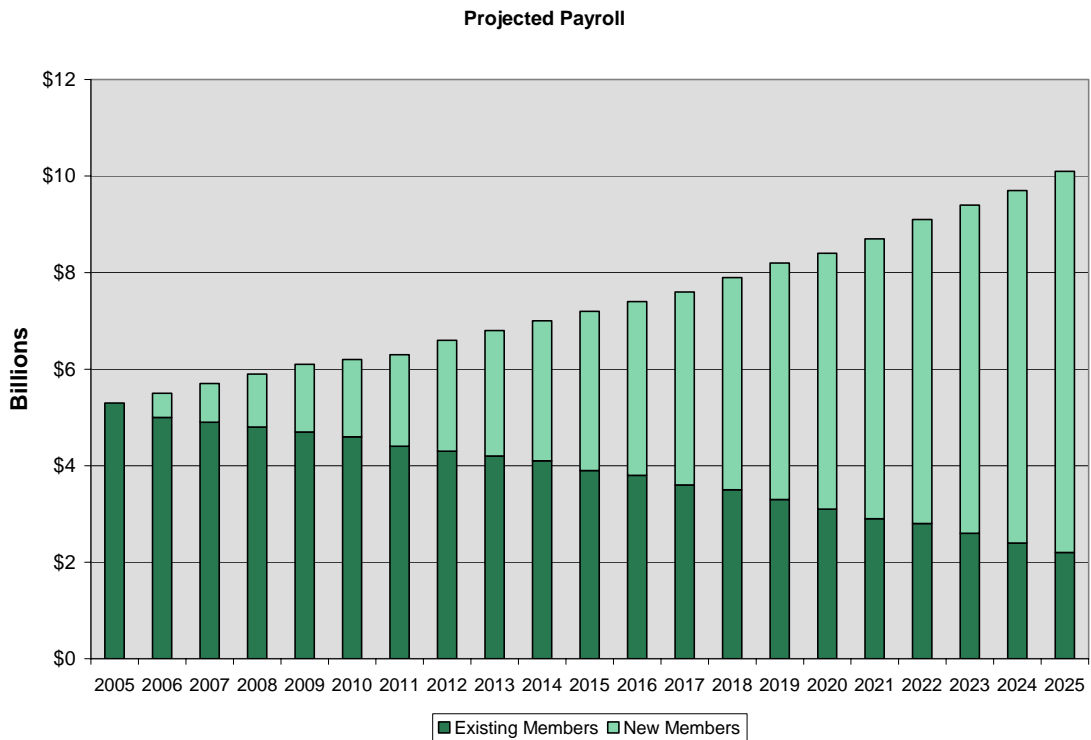
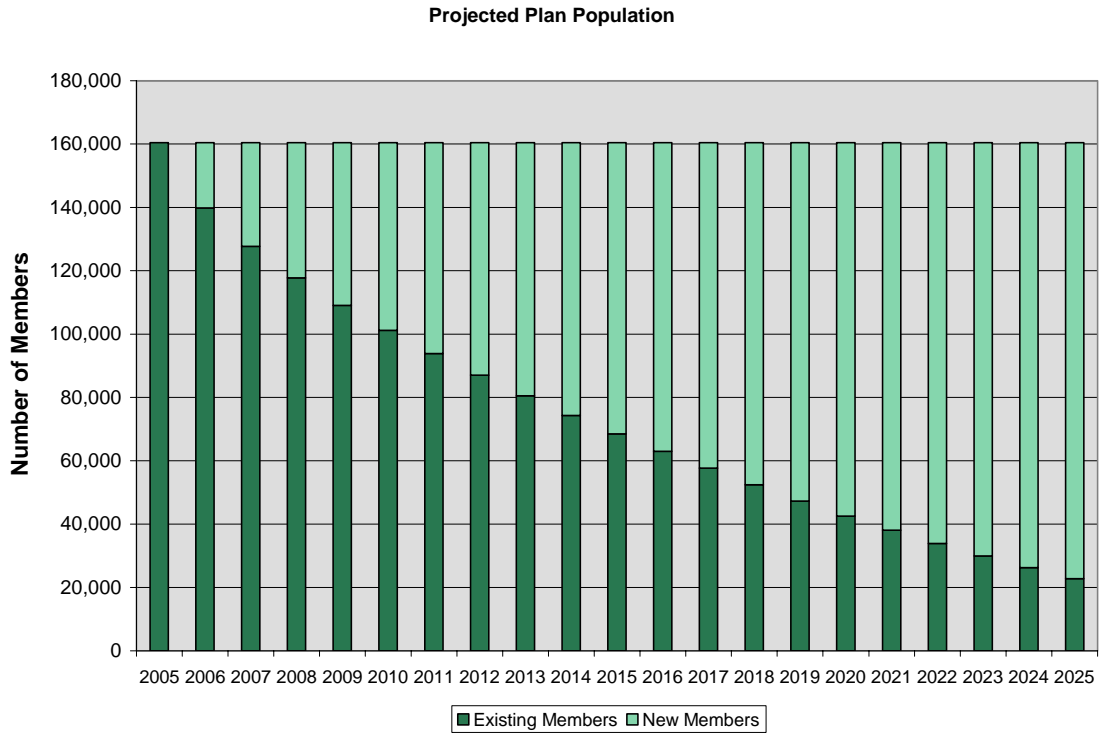
With regard to questions of long-term actuarial soundness, we have the following observations relating to our initial description of actuarially sound systems:

- *Funded ratios.* Under the current level of statutory contributions, funded levels will not move toward 100%, but are expected to decline dramatically over the next 20 years unless the fund can earn in excess of its assumed rate of return.
- *Stable required contributions:* Even if the fund earns its assumed rate of return, the gap between the actuarially required contributions and statutory contributions will continue to widen to the point where the statutory contributions are less than 60% of the actuarially required contributions. If the amortization period is changed to 30 years to follow GASB requirements, the differential between the statutory and actuarially required contributions would be even greater.

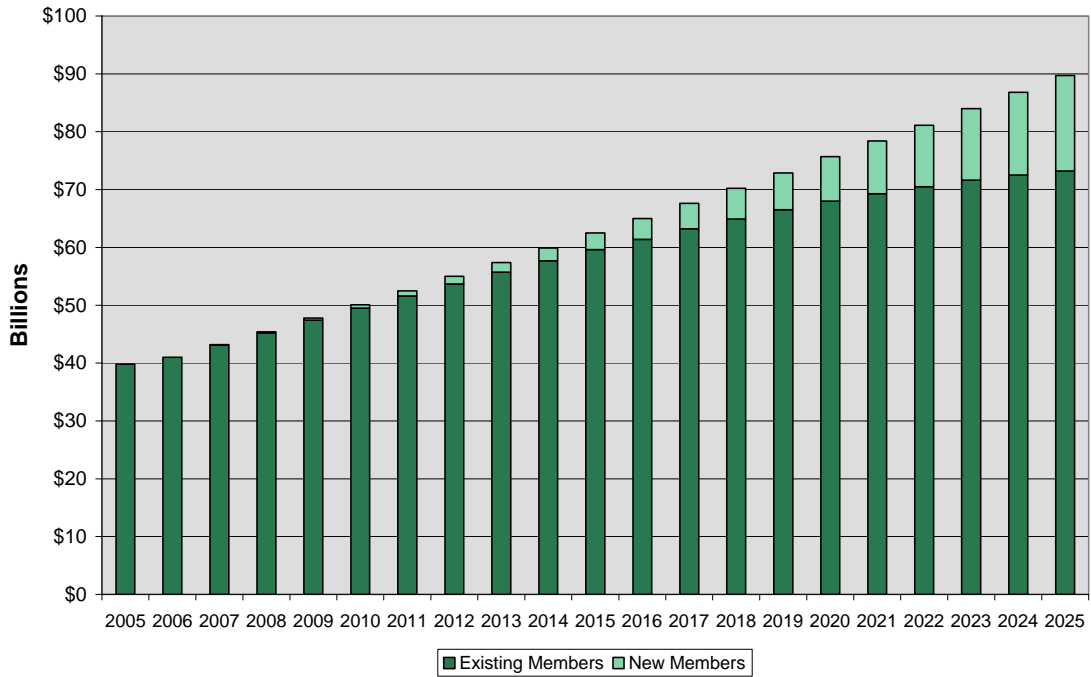
In order for PERA's long term funding to result in level or increasing funded ratios and stable actuarial contribution rates, some combination of the following will likely be required:

- Increase in the required employer and/or employee contribution rates above the current statutory levels (including AED contributions)
- Reduction in current benefit levels for existing employees, new employees or both
- Realization of investment returns that consistently exceed the current 8.5% assumption

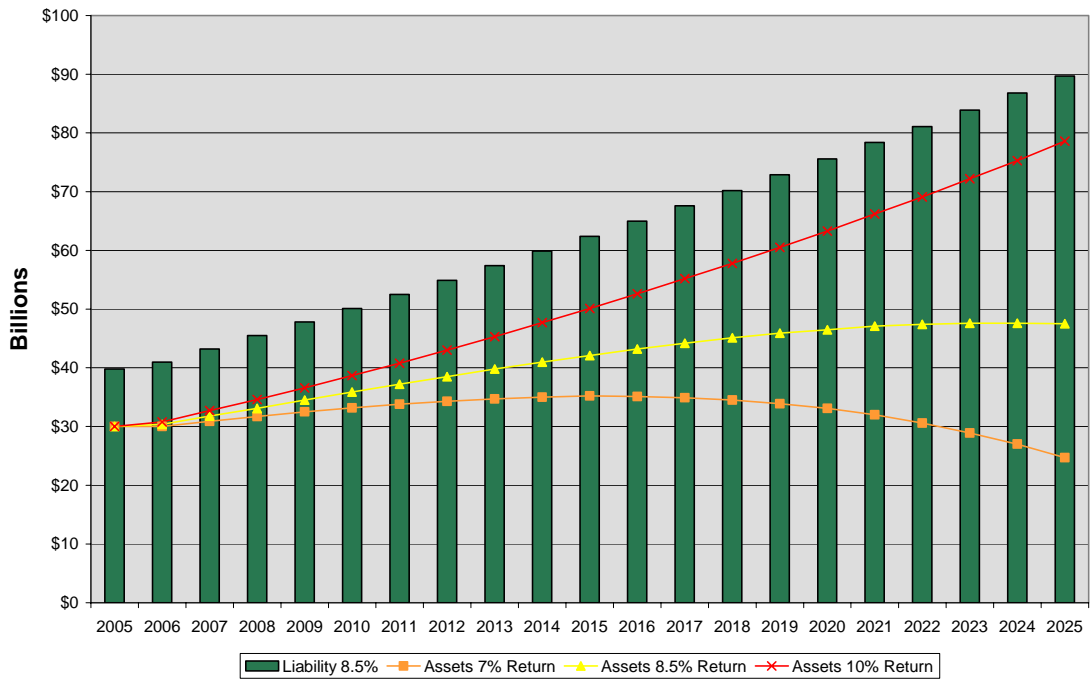
The results of the projections are shown below:



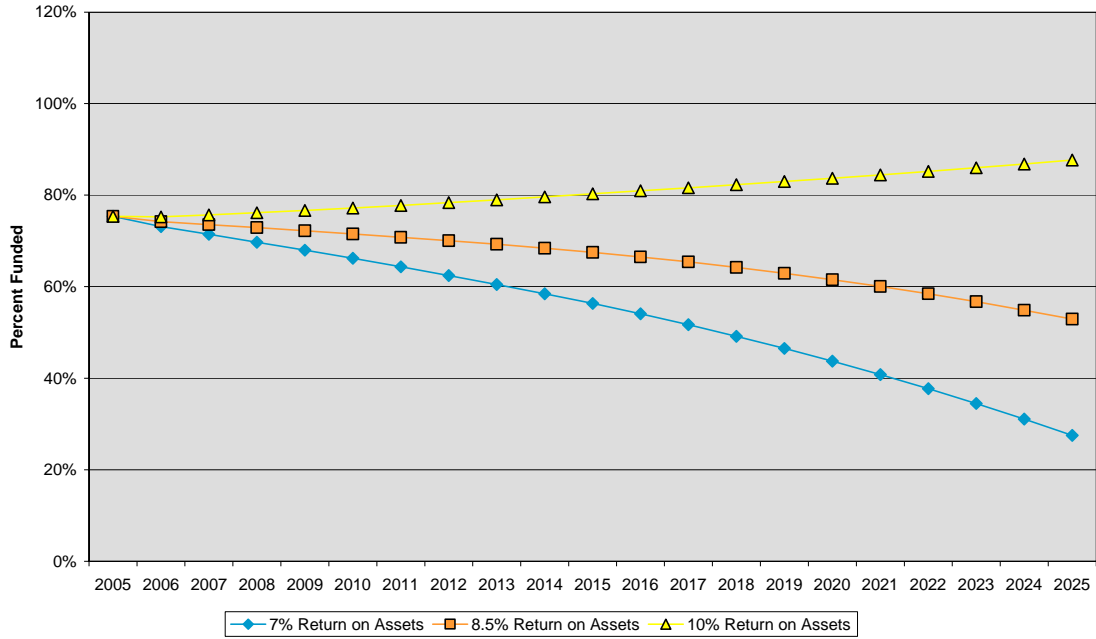
Projected Accrued Liability



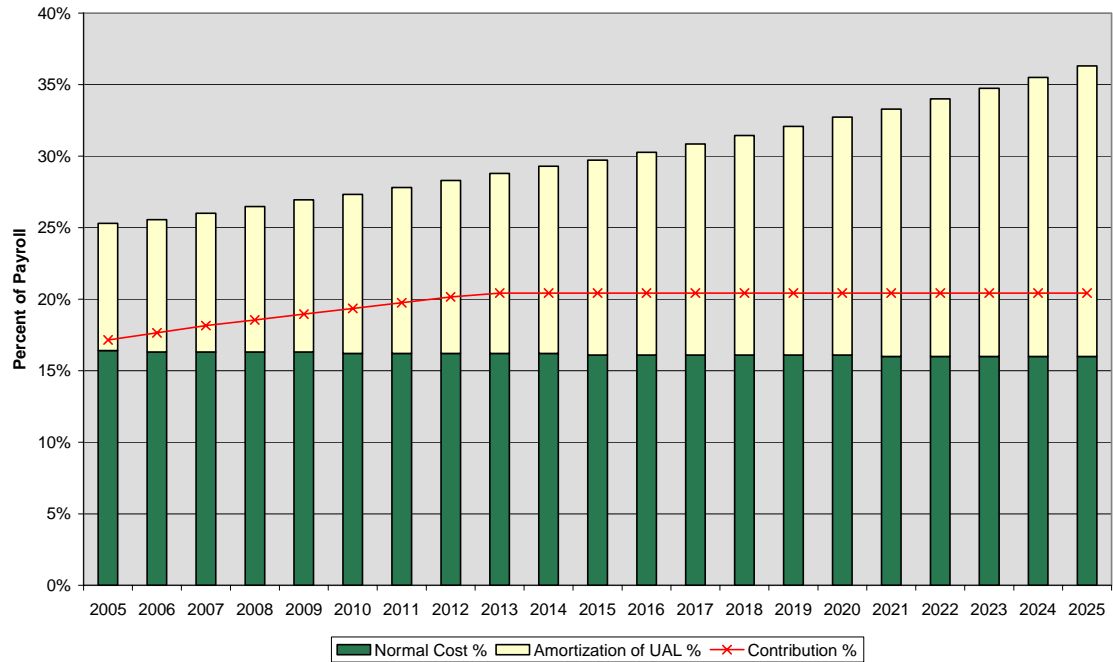
Projected Accrued Liability vs. Assets



Projected Funded Ratios



**Contribution Requirements as Percent of Payroll
Asset Return 8.5%, Before Reduction for AED**





Pension Obligation Bonds (POB)

As a part of the actuarial review, PERA requested an assessment of the advantages and disadvantages of using pension obligation bonds to pay off a portion of the PERA unfunded liabilities. One such proposal would have the State of Colorado issue bonds secured by PERA employer contribution increases from the Amortization Equalization Disbursement (AED). Under AED, employer contributions would be increased by 0.50% of payroll starting in 2006, gradually increasing to 3.00% of payroll for 2012 and later.

Paying off a portion of the unfunded liability of a pension system has been described as being similar to refinancing a home mortgage at a lower interest rate. PERA's current unfunded liability in effect is "charged" with interest each year at the assumed investment return rate of 8.5%. If bonds with an interest rate of 5% are issued and the proceeds used to reduce the unfunded liability, this transaction could be viewed as replacing a debt that has an 8.5% interest rate with a debt that has a 5% interest rate.

As of January 1, 2005, the total unfunded liability of the State and School Division is about \$12 billion based on the actuarial value of assets. Based upon the assumed actuarial rate of return of 8.5%, the interest charge for 2005 is about \$1 billion. If the liability were financed by bonds bearing an interest rate of 5%, the interest cost for the first year would be about \$600 million, for a theoretical first year savings of \$400 million. The proposal to use AED proceeds actually only finances about a third of the unfunded liability, but the theoretical initial annual savings would still be in excess of \$100 million, or about 2% of current valuation payroll. However, note that we have referred to these savings as "theoretical savings" as there are important differences between issuing a pension obligation bond and refinancing a mortgage. These are discussed further in this section.

The advantages of using pension obligation bonds are usually stated as follows:

1. Reduction in funding requirements. The addition of the proceeds to the pension fund will immediately reduce the required actuarially computed contribution. The issuer of the bonds will need to begin payments on the bonds according to the bond terms. If the interest rate on the bonds is less than assumed interest rate for the actuarial valuation, the net effect normally will be reduced overall funding requirements. In PERA's situation, the current statutory contribution rates after the POB would be covering a larger percentage of the actuarially required contribution.
2. Increased funded ratio. The addition of proceeds to the pension fund will increase the funded ratio (i.e. the ratio of the value of fund assets to the actuarial accrued liability) thus giving more assurance to plan members that the benefits are secure.
3. No effect on credit ratings. Credit rating agencies may view the issuance of pension obligation bonds as merely substituting one form of debt for another. In such a case, the total debt of the issuer has not been changed by the transaction and should therefore not affect the credit rating.

While using pension obligation bonds may look attractive to a plan sponsor and to the retirement system, there are a number of issues to consider before taking this step:

1. Measurement of liability. The unfunded pension liability is calculated using actuarial assumptions which may or may not prove to be reasonable over the long term, and which in all likelihood will be changed from time to time. On the other hand, the liability associated with the pension obligation bonds is fixed according to its terms. The issuer of the bonds and the taxpayers are therefore substituting a variable liability with a fixed liability.
2. Disclosure of liability. The liability associated with the bonds will appear directly on the face of the issuer's financial statement, while the unfunded pension liability is shown as supplemental information.
3. Bond interest rate. Since the issuance of pension obligation bonds is viewed by the U.S. Treasury Department as risk arbitrage, the bonds must be issued as taxable bonds. This treatment results in a higher interest rate than governments would typically have for other bonds.

4. Investment risk. The actual savings from pension obligation bonds will be determined from the excess (if any) of the actual investment earnings from the proceeds of the bonds over the interest rate paid on the bonds. We have previously indicated with this actuarial review that the median expected rate of return using the capital market assumptions from Mercer Investment Consulting is 7.70%, and that the probability of achieving the assumed rate of 8.50% is less than 40%. There is approximately a 20% chance that the investment return will be as low as 5%.

One way of measuring the effects of varying rates of return is to examine the differences in the fund at the end of 30 years, with or without the use of pension obligation bonds. With a 5% interest rate, the present value of the AED contributions over 30 years is about \$4.1 billion. If 5% bonds were issued for \$4.1 billion, then theoretically, the AED contributions over the next 30 years would exactly meet the bond obligation. The table below shows the differences in accumulated assets at the end of 30 years, comparing the accumulation (in billions) of the bond proceeds to the accumulation of the AED contributions, at 8.50% return, 7.70% return, 6.50% return, 5.00% return, and 3.00% return:

	8.50%	7.70%	6.50%	5.00%	3.00%
Bond Accumulation	47.8	38.3	27.4	17.9	13.8
AED Accumulation	29.3	26.0	21.9	17.9	10.0
Percent gain (loss) from bonds	63%	47%	25%	0%	(27%)

These simplified results show a wide variation of results at the end of the 30 year period. We recommend that any analysis of pension obligation bonds include calculations based upon various scenarios for the actual rate of return that would include results based upon adverse economic scenarios such as the negative returns that were experienced during the early 2000s.

5. Near term cash flow. For purposes of the actuarially required contribution amount, the PERA unfunded liability is being amortized as a level percentage of payroll rather than as fixed annual dollar amounts. This means that the current amortization payments are less than the interest on the unfunded liability. If these payments are replaced by level payments on a fixed debt, even if at a lower interest rate, the initial net funding requirements may increase rather than decrease after the transaction. For example, if pension obligation bonds are issued for \$4.1 billion as in the example above and amortized evenly over 30 years, the annual payment would be about \$250 million. However, the 40-year amortization reduction being funded as a level percent of payroll would only be a little over \$200 million.

6. Investment allocation. The one time addition of the bond proceeds to the pension fund requires decisions as to how to invest them. Should these funds be invested according to the regular asset allocation policy or should there be special considerations?
7. Credit rating issues. It is not clear that all credit rating agencies will view the transaction in neutral terms. Much will depend upon the current financial stability of the issuer.
8. Debt capacity issues. The issuer may have legal limits on the total amount of debt that can be issued and if these are defined independently of any unfunded pension liability, then the issuance of pension obligation bonds could exceed this limit, or at the very least reduce the amount available for other types of government financing.
9. Expectations of benefit increases. As plan members see a higher funded ratio, they may lobby for benefit increases without an understanding of the implications of the bonds which are not fully paid off. Also, any actions that would result directly from a higher funded ratio would need to be examined. For example, PERA previously provided a Matchmaker contribution when the funded ratio exceeded 100%.
10. Overfunding of liabilities. If the size of bond issuance is such that it fully funds or nearly funds all of the unfunded liability, then favorable investment experience could result in the plan becoming overfunded. Taxpayers may question the use of these funds in that instance.

This summary is not meant to be either an endorsement or a discouragement for using pension obligation bonds. Rather, it is meant to summarize various issues associated with these bonds and to encourage a thorough analysis of all issues before proceeding.

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