

# Pension Benefit Design Study

TEACHER RETIREMENT SYSTEM OF TEXAS  
September 1, 2012



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**1. While The TRS Pension Fund Can Pay Currently Projected Benefits Through 2075, The State Needs To Begin Addressing The Unfunded Liability. Delays Will Only Increase Costs.**

- ❖ The plan’s current funding policy of a 6.4% contribution from the State and a 6.4% contribution from active members is insufficient to sustain current benefits and amortize the \$24.1 billion unfunded actuarially accrued liability (UAAL), even if current assumptions are met.
- ❖ Revenue to address the unfunded liability can come from the State, members, or some combination of the two. Regularly funding the actuarially required contribution over time is more important than the amount of contributions in a single year. Options for increasing contributions are discussed in the Study. Changing benefits under the existing plan for new hires only does not have an impact on the current unfunded liability. The only way to affect the unfunded liability immediately is to adjust benefits for active members.

**The current funded ratio (ratio of assets to liabilities) exceeds 80% but will trend downward over time without a change in contribution rates, investment returns, or benefit levels.**

**Defined Benefit Representative Changes for All Current Active Members** Figure 1

| Provision   | Representative Change  | Unfunded Liability | State Contribution Rate for Actuarial Soundness* |
|---|--|--------------------|--|
| Current Provisions as of August 31, 2011                              |  | \$24.1B            | 8.13%  |
| Retirement Eligibility For Current Members Not Yet Eligible to Retire | From Rule 80 & Minimum Age 60 to Rule of 80 & Minimum Age 62 | \$14.7B            | 6.39%  |
| Salary Averaging Period   | From 5 Years to 7 Years                                      | \$20.4B            | 7.20%  |
| Accrual Multiplier  | From 2.3% Per Year to 2.0% Per Year                          | \$21.9B            | 6.69%  |
| Member Contribution Rate  | From 6.4% Per Year to 7.4% Per Year                          | \$23.4B            | 7.31%  |

\* State contribution rate for actuarial soundness is based on smoothed assets and is the rate necessary to pay for new benefit accruals and amortize the unfunded liability of \$24.1 billion over a period that is less than 31 years.

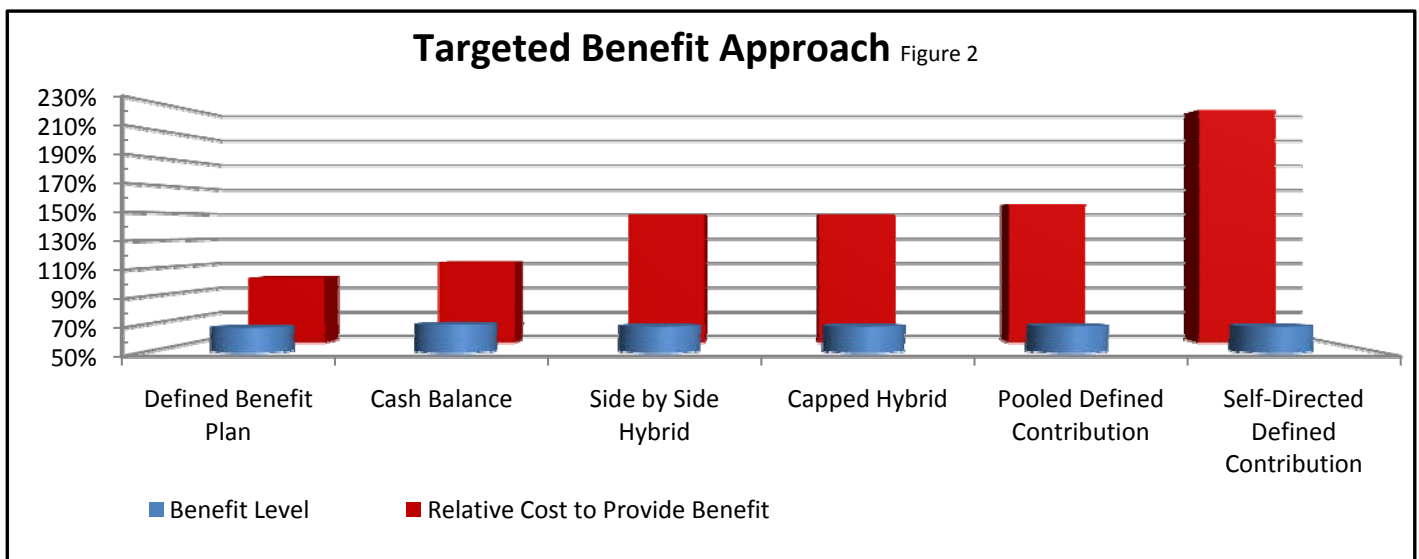
**2. The Value Of The Retirement Benefit Available To TRS Members Is 36% Less Than The Average Benefits Available To Members of Peer Systems.**

- ❖ TRS examined the value of its members’ benefits relative to the benefits provided by a variety of peer systems, including local plans and other statewide public employee and teacher systems. A prototypical TRS career employee (one who retires at age 62 with 32 years of service credit) receives a lifetime benefit that equates to 52% of pre-retirement income while the average benefit available to the same prototypical employee of the peer plans examined was 82% of pre-retirement income.

- ❖ The modesty of TRS’ benefit is due, primarily, to the lack of an automatic cost-of-living increase. The 52% benefit value reflects the loss of purchasing power over time. Members of the peer plans examined received some type of purchasing power protection either through automatic cost-of-living increases or because the members participated in both a retirement plan and Social Security.

### 3. The Defined Benefit Plan Provides Current Benefits At A Lower Cost Than Alternative Plans.

- ❖ In conducting the Study, TRS modeled the alternative plans using two different approaches: the “Targeted Benefit Approach” and “Targeted Contribution Approach.” The TRS benefit, as currently designed, replaces roughly 68% of a career employee’s pre-retirement income before a loss of purchasing power. Therefore, TRS modeled the plans in the “Targeted Benefit Approach,” to provide the same level of benefit as the current plan regardless of cost. As shown in Figure 2, TRS determined that the alternative plans would be 12% to 138% more expensive than the current plan (not including the cost to pay off any unfunded liability) to provide the same level of benefit.
- ❖ Conversely, under the “Targeted Contribution Approach,” TRS modeled the alternative plans to cost the same as the current plan regardless of the benefit level provided. Under this approach, TRS determined that the alternative plans would replace 27.7% to 59.7% of pre-retirement income for a career employee retiring at age 62.



|                                  |  |
|----------------------------------|--|
| Cash Balance Plan                | Member receives pay and investment credits into a “virtual account.” Contributions invested through TRS trust fund. At retirement account balance can be annuitized.   |
| Side by Side Hybrid              | Members and State contribute to both a small defined benefit plan and a small defined contribution plan with the idea that both plans, together, provide the targeted level of benefits. Defined benefit contributions are invested through TRS trust fund. The defined benefit is annuitized. Defined contribution investments are self-directed and are taken as lump sum at retirement. |
| Capped Hybrid                    | Similar to Side by Side Hybrid, but the State contribution is capped. All contributions from the members and the State go first towards paying the actuarially required contribution (ARC). Any remaining contributions after ARC is paid go toward defined contribution plan. Members are responsible for paying any portion of the ARC above the State’s capped contribution.            |
| Pooled Defined Contribution      | Like a traditional defined contribution plan but contributions are pooled and invested by TRS. Lump sum distribution is taken at retirement.   |
| Traditional Defined Contribution | Investments are self-directed and member must manage account for duration of retirement.   |

#### **4. The Majority Of TRS Members Will Do Significantly Worse Investing On Their Own In A Plan With A Defined-Contribution Component.**

- ❖ In any plan with a self-directed defined-contribution component, TRS members would make their own investment decisions. The resulting difference between individual returns would likely be very wide. TRS modeling has shown that under a defined contribution plan, 92% of retirees will ultimately receive less than the current defined benefit. Two-thirds would receive no more than 60% of the current benefit. Only a handful (about 8%) would receive more than the current benefit.
- ❖ The estimated underperformance is attributable to lower investment returns from a shorter investment period, access to fewer asset classes, less disciplined investment approaches, and potentially higher fees.

#### **5. Alternative Plan Structures Carry Differing Levels Of Risk For The State And TRS Members.**

- ❖ While alternative plan structures are more expensive than the current plan for a comparable level of benefit, they can shift risk away from the State. A defined contribution plan, such as a 401(k) plan, transfers most of the risk to the members because they become responsible for managing their own investments for the remainder of their lives.
- ❖ Changing structures from a defined benefit plan to an alternative plan can present other risk factors, including how to manage the unfunded liability of the legacy defined benefit plan and the risk that diminished retirement income could increase retiree use of social services post-retirement due to a lack of retirement self-sufficiency.

#### **6. Other Systems Changing Structures Have Lowered Benefits To Realize Savings.**

- ❖ Research shows that other systems moving away from defined benefit plans reduced benefits along with changing plan design. This supports the finding that a change in plan structure alone will not achieve savings. TRS identified six systems that have moved to an alternative plan design and for which data regarding plan structure and benefit level were available. TRS measured the benefit level provided by those systems both before and after the change and determined that the benefits provided were reduced by an average of 30% as part of moving to an alternative plan.
- ❖ TRS also examined the most common benefit reductions made by other public plans in 2010 and 2011 and determined that the State has already incorporated into the TRS plan many of the cost-saving measures other systems are adopting.

**The State limits behavior that damages trust funding, including restricting return-to-work after retirement and prohibiting salary spiking.**

## 7. Moving New Hires To An Alternative Plan Will Not Eliminate Existing Liabilities.

- ❖ TRS' unfunded liability represents benefits already earned by current participants, and as such the State cannot eliminate it by closing the plan to new hires. Regardless of plan structure, the unfunded liability will have to be addressed eventually either through amortization (paying it off) or a reduction of benefits.
- ❖ If the State were to close the current plan to new hires, then the trust's liquidity needs will increase as the plan matures. This could cause the liability to grow by an estimated \$11.7 billion (to \$35.7 billion) due to lower investment returns as TRS transitions the trust over five to 10 years to a more liquid asset allocation.

## 8. Approximately 95% of Public School TRS Members Do Not Participate In Social Security, Leaving The TRS Benefit As Their Only Lifetime Annuity.

- ❖ 80% of TRS members, a figure that includes 95% of public school TRS members, do not participate in Social Security. For many TRS members, the only source of lifetime income in retirement is TRS. A lifetime benefit, such as TRS or Social Security, mitigates the risk of a retiree who—due to longevity, market volatility or failure to invest adequately—outlives his or her savings.
- ❖ Not participating in Social Security saves Texas public school employers an estimated \$1.5 billion annually. The level of retirement benefit governs mandatory Social Security participation. Therefore, if benefits were reduced enough, the school districts and members may be required to each contribute 6.2% to Social Security on top of the State and member contributions to a pension plan, as required by the Texas Constitution.

**If left with only a defined contribution plan, the majority of Texas public school educators would face retirement without the dependability of a lifetime benefit.**

### Other Issues

Finally, there are additional legal, policy, and transitional issues to consider as the State weighs making changes to the current plan, including:

- ❖ Operational and funding requirements of the Texas Constitution, Article XVI, Section 67;
- ❖ The implications of new accounting standards from the Governmental Accounting Standards Board (GASB) that will impact how the State reports TRS' unfunded liability; and
- ❖ Process and transition considerations, including implementation time frames, potential grandfathering, and system modifications associated with any adopted change.

The following Charts A, B, and C provide an overview of the pension benefit design options TRS modeled.

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# Chart A

## Modeled Changes to Current Defined Benefit Plan for New Hires

| Provision                                | Current Provisions       | Illustrated Provisions   | Cost of New Benefit Accruals | Unfunded Liability | Funding Period* | State Contribution Rate for Actuarial Soundness** | Percent of Pre-retirement Income Replaced |
|--|--------------------------|--------------------------|------------------------------|--------------------|-----------------|---|---|
| Current Provisions as of August 31, 2011 |                          |                          | 10.6%                        | \$24.1B            | Never           | 8.13%   | 67.8%                                     |
| Retirement Eligibility                   | Rule 80 & Minimum Age 60 | Rule 80 & Minimum Age 62 | 10.39%                       | \$24.1B            | Never           | 8.02%   | 67.8%                                     |
| Salary Averaging Period                  | 5 years                  | 7 years                  | 10.27%                       | \$24.1B            | Never           | 7.97%   | 65.2%                                     |
| Accrual Multiplier                       | 2.3% Per Year            | 2.0% Per Year            | 9.51%                        | \$24.1B            | Never           | 7.6%  | 59.0%                                     |
| Member Contribution Rate                 | 6.4% Per Year            | 7.4% Per Year            | 10.9%                        | \$24.1B            | Never           | 7.79%   | 67.8%                                     |

\*Funding period is based on a 6.40% member and state contribution rate (12.8% combined).

\*\* The State Contribution Rate for Actuarial Soundness is based on smoothed assets.

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## Chart B

# Modeled Changes to Current Defined Benefit Plan for All Current Actives

| Provision                                | Current Provisions       | Illustrated Provisions   | Cost of New Benefit Accruals | Unfunded Liability | Funding Period** | State Contribution Rate for Actuarial Soundness*** | Percent of Pre-retirement Income Replaced |
|--|--------------------------|--------------------------|------------------------------|--------------------|------------------|--|---|
| Current Provisions as of August 31, 2011 |                          |                          | 10.6%                        | \$24.1B            | Never            | 8.13%  | 67.8%                                     |
| Retirement Eligibility *                 | Rule 80 & Minimum Age 60 | Rule 80 & Minimum Age 62 | 10.39%                       | \$14.7B            | 30 Years         | 6.39%  | 67.8%                                     |
| Salary Averaging Period                  | 5 Years                  | 7 Years                  | 10.27%                       | \$20.4B            | 70 Years         | 7.2%   | 65.2%                                     |
| Accrual Multiplier                       | 2.3% Per Year            | 2.0% Per Year            | 9.51%                        | \$21.9B            | 36 Years         | 6.69%  | 59.0%                                     |
| Member Contribution Rate                 | 6.4% Per Year            | 7.4% Per Year            | 10.9%                        | \$23.4B            | 69 Years         | 7.31%  | 67.8%                                     |

\*Changes to retirement eligibility above would not apply to active members eligible to retire as of September 1, 2012.

\*\* The funding period is based on a 6.40% member and state contribution rate (12.8% combined).

\*\*\*The State Contribution Rate for Actuarial Soundness is based on smoothed assets.

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# Chart C

## Alternative Plan Models

| Structure   | Features   | Modeled to Provide Same Level of Benefits as Current Plan |        | Modeled to Cost the Same as the Current Plan |        |   | Unfunded Liability*** | Risk                            |
|---|--|---|--------|--|--------|---|-----------------------|---------------------------------|
|   |  | Contributions   |        | Contributions*                               |        | Percent of Pre-retirement Income Replaced |                       |                                 |
|   |  | State   | Member | State  | Member |   |                       |                                 |
| Current Defined Benefit Plan                                    | Maintain current benefit & funding   | 4.2%  | 6.4%   | 4.2%   | 6.4%   | 67.8%                                     | \$24.1B               | State                           |
| Side by Side Defined Benefit - Defined Contribution Hybrid Plan | Defined benefit fully funded by State; Member funds defined contribution   | 9.4%  | 6.4%   | 4.2%   | 6.4%   | 55.1%                                     | \$24.1B               | Shared Between member and state |
| Capped Defined Benefit - Defined Contribution Hybrid Plan       | Defined benefit fully funded first; Remainder goes to defined contribution | 5.42%   | 6.4%   | 4.2%   | 6.4%   | 59.7%                                     | \$24.1B               | Shared Between member and state |
| Cash Balance Plan   | Interest Credited on 5 yr average investment earnings                      | 9.4%  | 6.4%   | 4.2%   | 6.4%   | 55.1%                                     | \$24.1B               | Shared between member and state |
| Pooled Defined Contribution Plan                                | TRS invests contributions  | 10.9%   | 6.4%   | 4.2%   | 6.4%   | 40.9%                                     | \$35.8B               | Member                          |
| Self-Directed Defined Contribution Plan                         | Member invests contributions   | 18.89%  | 6.4%   | 4.2%   | 6.4%   | 27.7%                                     | \$35.8B               | Member                          |

\*Contributions under this model target a 10.6% contribution rate as opposed to the 12.8% current contribution received because the cost to provide the accrual of benefits under the current plan is 10.6% with the remaining 2.2% going toward paying down the unfunded liability.

\*\*Assumes member hired at age 30, retires at age 62 with 32 years of service and 5 year cliff vesting across all plans.

\*\*\*Assumes that only new TRS members will be placed into the alternative plan and active members will stay in current defined benefit plan.

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## I. Study Charge

In 2011, the Texas Legislature directed the Teacher Retirement System of Texas (TRS) to conduct a pension benefit design study. The Study charge directs TRS to examine the actuarial and fiscal impacts of the following two potential changes:

- Changing the benefit factors of the current plan, which includes changes in the retirement eligibility, final average salary, and benefit multiplier provisions of the current plan.
- Moving to an alternative plan design, such as a cash balance plan or defined benefit-defined contribution hybrid plan.

To conduct the Study, TRS formed a working group that included a cross-section of agency personnel and TRS' pension actuary, Gabriel, Roeder, Smith & Company (GRS). TRS presented Study updates at four TRS Board meetings and two town hall meetings. Three of the six meetings offered the public an opportunity to provide input and ask questions about the Study. All six of the meetings were webcast, and the archived webcasts can be accessed at <http://www.trs.state.tx.us>. TRS also accepted Study comments from the public through a form on its website.

TRS submitted its Study on September 1, 2012.

## II. TRS Plan Profile

To place the Study findings in context, it is useful to review TRS' pension plan design, including how TRS compares to other plans in terms of contributions, investment returns, and benefits.

The TRS pension plan operates as a defined benefit plan. Under the plan, a portion of the employee's income is contributed to the plan by the State and the member as a type of deferred compensation to pre-fund retirement benefits. This contribution goes into a pension trust fund that TRS then invests to generate a return.

The time horizon over which TRS invests the contributions is very long. In fact, the amount of time that TRS has to invest contributions before the average future benefit payment becomes due is 27 years. Upon retirement, the employee receives the deferred compensation through a retirement benefit based on a formula set in state statute. The formula includes factors such as how much TRS service credit the employee has earned and the employee's highest years of salary. At its core, the pension plan design equation is contributions plus investment returns equals benefits. Each of these discrete elements of the plan design equation is examined in greater detail in the following pages.

## Contributions

The Texas Constitution, Article XVI, Section 67 establishes a retirement system for public education employees. The Constitution does not require that the system be a defined benefit plan, but it does set parameters for the system, including a minimum contribution requirement.

The Constitution provides that the State must contribute at least 6%, but no more than 10%, of aggregate payroll of the system and that the members must contribute at least 6% of their income to the plan. Employers, which consist of school districts and higher education institutions, contribute to TRS in limited circumstances, but they are a minor source of benefit funding. The contribution rates set by the Texas Legislature have varied in the years since the plan’s inception. The following table, Figure 2.1, shows historical contribution rates.

**TRS contribution rates are among the lowest in the nation. Compared to other plans, TRS offers a modest benefit that does not contain an automatic cost-of-living adjustment.**

**State and member contribution rates 1980-2012**

| Fiscal Year(s) | State Contribution Rate | Member Contribution Rate | Total Contribution Rate | ARC Contributed |
|----------------|-------------------------|--------------------------|-------------------------|-----------------|
| 1980-83        | 8.5%                    | 6.65%                    | 15.15%                  | Not Available   |
| 1984-85        | 7.1%                    | 6.0%                     | 13.1%                   | Not Available   |
| 1986-87        | 8.0%                    | 6.4%                     | 14.4%                   | Not Available   |
| 1988-89        | 7.2%                    | 6.4%                     | 13.6%                   | Not Available   |
| 1990-1991      | 7.65%                   | 6.4%                     | 14.05%                  | Not Available   |
| 1992 - 1995    | 7.31%                   | 6.4%                     | 13.71%                  | Not Available   |
| 1996-2002      | 6.0%                    | 6.4%                     | 12.4%                   | Yes             |
| 2003-2007      | 6.0%                    | 6.4%                     | 12.4%                   | No              |
| 2008-2009      | 6.58%                   | 6.4%                     | 12.98%                  | Yes             |
| 2010-2011      | 6.644%                  | 6.4%                     | 13.044%                 | No              |
| 2012           | 6.0%                    | 6.4%                     | 12.4%                   | No              |

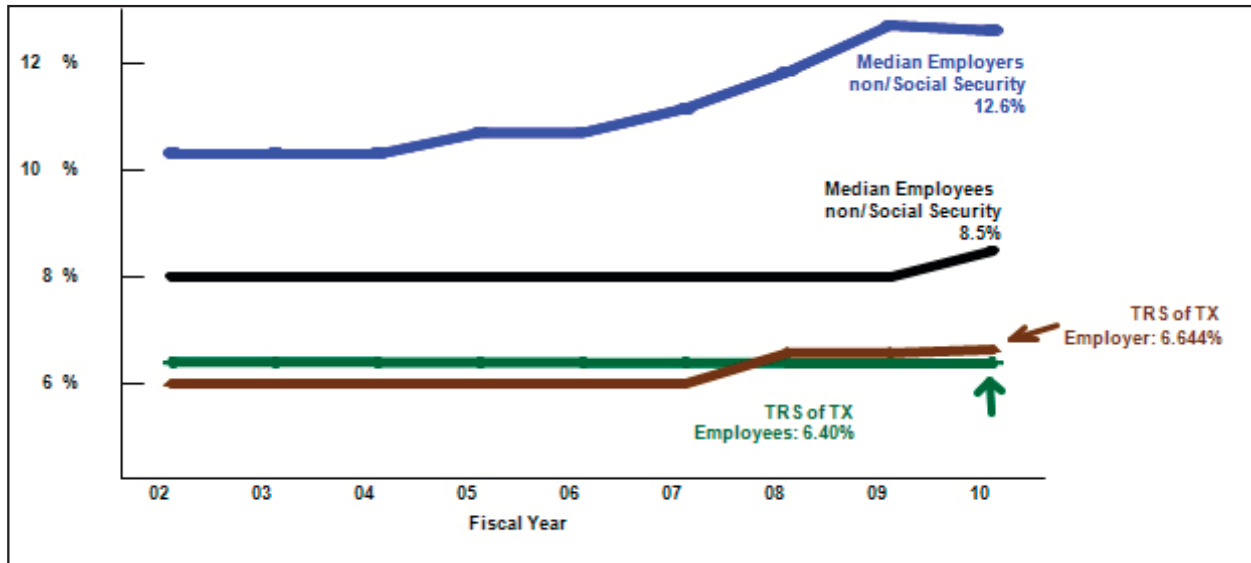
Source: Teacher Retirement System of Texas and Gabriel, Roeder, Smith & Company Figure 2.1

Two significant periods are 1980-1995, during which the State contribution rate ranged from 7.1% to 8.5%, and 1996-2007, during which the State contributed the constitutional minimum of 6%. With the exception of 2008-2009, the State has not made the actuarially required contribution (ARC) since 2002. The ARC is the amount of contributions necessary to be able to pay for the accrual of new benefits plus amortize any unfunded plan liability over a period that is less than 31 years.

TRS contribution rates are among the lowest in the nation. Compared to other plans, TRS offers a modest benefit that does not contain an automatic cost-of-living adjustment. This modest benefit, along with consistent investment returns, has helped keep TRS contribution rates low. Figure 2.2 compares TRS’ contribution rates against the median employer and employee contribution rates of other public retirement systems. The comparison is to employers and employees who do not participate in Social Security because approximately 80% of active TRS members, which includes 95% of TRS members working in public schools, do not participate in Social Security.

## TRS Compared to Median Contribution Rates FY 02 to FY 10

General employees and public school teachers *Figure 2.2*



Source: NASRA, 2011 (does not include Public Safety employees)

## Contribution Rates in the Top 10 U.S. Public Pension Funds

*Figure 2.3*

| System   | Employer Contribution | Employee Contribution         |
|--|-----------------------|-------------------------------|
| California Public Employees' Retirement System | 15.7% (average)       | 5.00% (state); 7.00% (school) |
| California State Teachers' Retirement System   | 10.79%                | 8.00%                         |
| New York State and Local Retirement Systems    | 11.90% (average)      | 3.00%                         |
| Florida Retirement System                      | 9.66%                 | 3.00%                         |
| Teacher Retirement System of Texas             | 6.00%                 | 6.40%                         |
| New York State Teachers' Retirement System     | 8.62%                 | 0 – 3.50%                     |
| New Jersey Division of Pensions and Benefits   | 7.05% (average)       | 6.50%                         |
| Wisconsin Department of Employee Trust Funds   | 4.80%                 | 5.00%                         |
| State Teachers Retirement System of Ohio       | 13.00%                | 10.00%                        |
| Ohio Public Employees Retirement System        | 14.00%                | 10.00%                        |

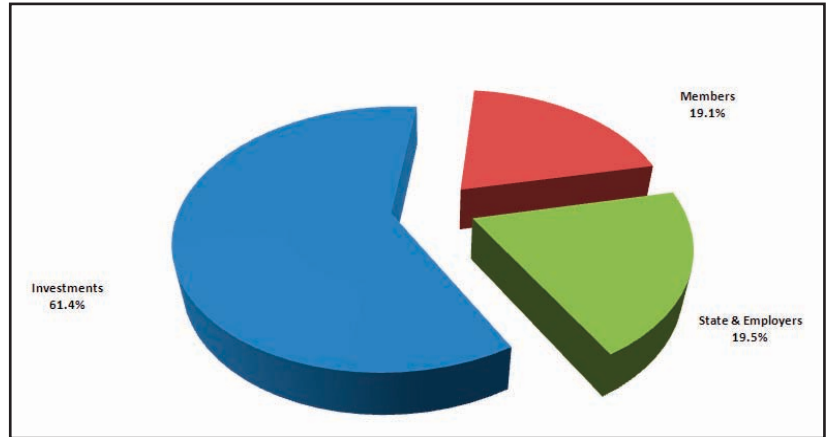
Source: NASRA, 2011 (does not include Public Safety employees or Social Security contributions where applicable)

## Investment Returns

TRS invests the member and State contributions through the pension trust fund to generate returns, which account for the majority of pension plan revenue. As shown in Figure 2.4, since the inception of the fund, investment earnings have accounted for roughly 61.4% of pension fund revenue and member and State/employer contributions have accounted for 38.6% of pension fund revenue.

**Sources of Pension Fund Revenue Since Inception (1938-2011)**

Figure 2.4



TRS approaches investment of the pension trust fund with a long-term perspective. This means that the trust fund’s investment portfolio is structured to equal or exceed the Board-adopted assumed rate of return over the long term.

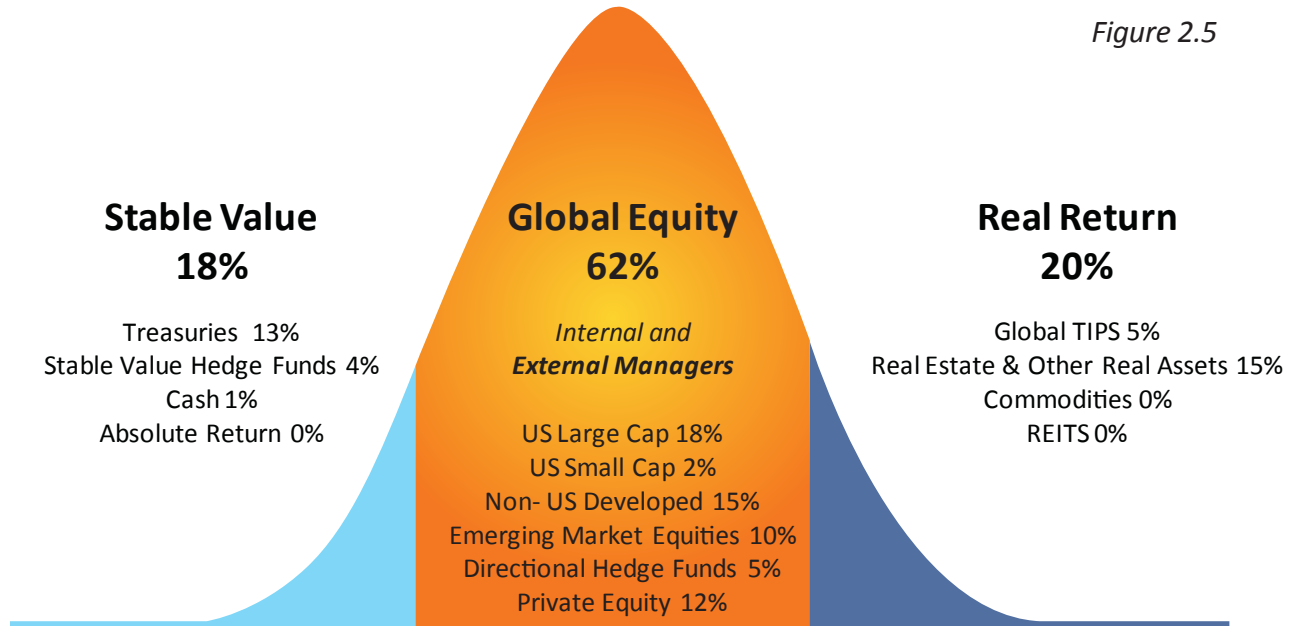
Source: Teacher Retirement System of Texas. A Great Value for All Texans, January 2012

The return of the TRS trust fund over the past 25 years has been 8.6%,<sup>1</sup> which is higher than the 8% assumed long-term rate of return adopted by the Board. The return, however, was delivered through above average returns in the first 15 years and below average returns in the last 10 years. Additionally, while TRS’ projected return long-term rate is 8%, actual returns will fluctuate lower or higher in accordance with economic cycles.

Exceeding the 8% long-term rate of return adopted by the Board comes from a disciplined, consistent, investment approach that is structured to control risk by diversification of asset classes. Figure 2.5, depicts the diversification framework for the trust fund. The diversification framework has helped TRS outperform its peers. For the three-year period ending March 31, 2012, TRS was ranked second out of 66 competing investment programs on the delivery of risk-adjusted returns<sup>2</sup>.

# TRS Diversification Framework

Figure 2.5



Source: Teacher Retirement System of Texas, Target Weights as of October 1, 2011

## Benefits

As previously discussed, both the State and each member contribute to TRS during the member’s working years. Upon retirement, a formula determines the amount of the member’s annuity. The member then receives that annuity as a lifetime benefit. The formula is not set by the Board of Trustees; rather, it is set in statute.

It is important to note that TRS benefits do not include an automatic cost-of-living adjustment (COLA) for retirees, which has helped to prevent major funding issues. TRS’ current standard annuity benefit formula is a member’s total years of service credit, the average of the member’s highest five annual salaries (three annual salaries for members grandfathered from the 2005 benefit changes), and a 2.3% multiplier.

## Benefit History

As recently as 2005, the Texas Legislature adjusted the formula to reduce member benefits. Additionally, while the Board cannot amend the annuity formula, the Board does have authority to adopt rules governing plan administration. Pursuant to that authority, the Board adopted rule changes to control benefit liabilities in 2011. Figure 2.6, shows plan features and recent benefit reductions adopted by the Legislature and the Board to control plan liabilities.



| Features to Control Plan Liabilities |  |
|--------------------------------------|--|
| Present                              | <ul style="list-style-type: none"> <li>• TRS has never enacted an automatic cost-of-living adjustment (COLA). No permanent COLA since 2001.</li> </ul>   |
| 2011                                 | <ul style="list-style-type: none"> <li>• Purchase of most types of service credit now requires payment of actuarial cost.</li> </ul>   |
| 2011                                 | <ul style="list-style-type: none"> <li>• Controlling salary “spiking”: TRS has a 10% or \$10,000 (whichever is greater) limit on creditable compensation increases used to calculate retirement benefits, for salary increases occurring in last years before retirement.</li> </ul> |
| 2005                                 | <ul style="list-style-type: none"> <li>• Retirement age: For members joining after 8-31-07, member must be at least age 60 and meet the rule of 80 to retire without actuarial reductions.</li> </ul>  |
| 2005                                 | <ul style="list-style-type: none"> <li>• Final average salary (FAS): For most members, retirement benefits now are calculated using a 5 year FAS instead of a 3 year FAS.</li> </ul>   |
| 2005                                 | <ul style="list-style-type: none"> <li>• Service credit purchases: Members may no longer purchase up to 3 years of service credit (“air time”) to reach retirement eligibility earlier or increase benefit amount.</li> </ul>  |
| 2005                                 | <ul style="list-style-type: none"> <li>• Eligibility for a partial lump sum increased to a Rule of 90.</li> </ul>  |
| 2005                                 | <ul style="list-style-type: none"> <li>• Enacted the nation’s toughest laws regarding return-to-work after retirement. Public school education employers who hire retirees must pay TRS pension and health care surcharges.</li> </ul>   |

Source: Teacher Retirement System of Texas

Figure 2.6

In addition to benefit reductions, the State has enhanced benefits and given annuity increases when the plan was actuarially sound. Multiplier increases in 1999 and 2001 were applied not only to active members but also to retiree annuities. Additionally, Consumer Price Index inflation adjustments were granted to retirees in 1995, 1997, 1999, and 2001. A 13th check was paid in 2008, but retirees have not received a permanent COLA since 2001.

## TRS Benefit Compared to Peers

### TRS Benefit Compared to Other Public Employee and Teacher Retirement Systems

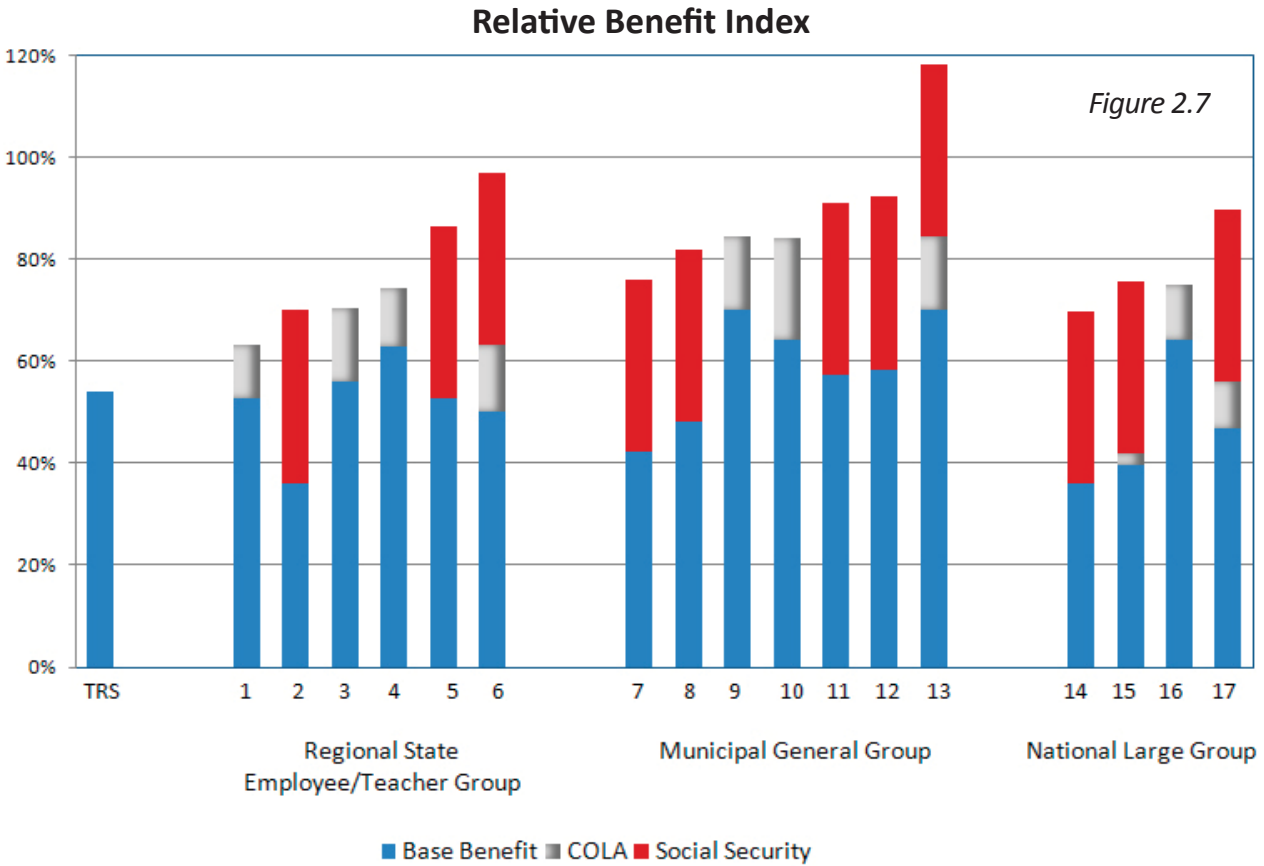
In order to ascertain how the level of retirement benefits provided by TRS compares to the benefits provided by other retirement systems, a Relative Benefit Index (Index) was developed that quantifies the differences. The Index, developed for this study, measures the value of retirement income provided to a prototypical career employee from the time the member retires until the member no longer receives retirement benefits. A career employee is defined as one who retires at age 62 with 32 years of service and a final salary of \$45,000 annually. This is very close to the median TRS member.

An Index score of 100 means that a plan provides a benefit with a value equal to full salary replacement and a COLA consistent with Consumer Price Index-Urban (CPI-U). The Relative Benefit Index also incorporates the impact of Social Security benefits, if applicable.

The chart below, Figure 2.7, shows the Index comparison. This figure compares TRS benefits to peer retirement systems consisting of the following:

- Teacher and public employee systems from the surrounding states and the Employees Retirement System of Texas.
- Local and municipal retirement systems within Texas.
- The four largest public retirement systems in the country.

Many systems have lowered their benefits for new members; therefore, the Index compares the TRS benefit for new hires to that received by new hires in the peer systems.



Source: Teacher Retirement System of Texas and Gabriel, Roeder, Smith & Company

As shown by the Index illustrations, the prototypical career member from TRS receives a benefit that equates to 52% of the member’s pre-retirement income. This 52% reflects the loss of purchasing power a retiree experiences over time. This is the lowest benefit value amongst the peer groups. The average available benefit replaces 82% of pre-retirement income. A significant portion of the value difference results from all of the peer systems either providing some level of automatic COLA or participating in Social Security coverage. The TRS plan is the only one in which no amount of the member’s retirement income is protected against inflation. The peer groups and benefit provisions depicted in the Index are listed in Figure 2.8.

**Peers Reflected in the Relative Benefit Index**

Figure 2.8

| <b>Plan Name</b>   | <b>Current Cost of Living Adjustments</b> | <b>Participate in Social Security</b> |
|--|---|---------------------------------------|
| Teacher Retirement System of Texas (New Members) .....                   | 0.00%.....                                | No                                    |
| Arkansas Teacher Retirement System .....                                 | 3.00%.....                                | Yes                                   |
| City of Austin Employees' Retirement System (New Members).....           | 0.00%.....                                | Yes                                   |
| Colorado Public Employees Retirement Association (New Members) .....     | 2.00%.....                                | No                                    |
| Employees Retirement Fund of the City of Dallas .....                    | 3.00%.....                                | No                                    |
| Employees Retirement System of Texas (New Members) .....                 | 0.00%.....                                | Yes                                   |
| Houston Municipal Employees Pension System (New Members) .....           | 0.00%.....                                | Yes                                   |
| New Mexico Educational Retirement Board (New Members).....               | 2.00%.....                                | No                                    |
| Oklahoma Teachers Retirement System (New Members) .....                  | 0.00%.....                                | Yes                                   |
| Teachers Retirement System of Louisiana (New Members) .....              | 2.50%.....                                | No                                    |
| Texas County and District Retirement System .....                        | 0.00%.....                                | Yes                                   |
| Texas Municipal Retirement System (5% Contributions and 2/1 Match) ..... | 0.00%.....                                | Yes                                   |
| Texas Municipal Retirement System (7% Contributions and 2/1 Match) ..... | 2.10%.....                                | Yes                                   |
| Texas Municipal Retirement System (7% Contributions and 2/1 Match) ..... | 2.10%.....                                | No                                    |
| Florida Retirement System .....  | 0.00%.....                                | Yes                                   |
| New York State and Local Retirement System .....                         | 1.50%.....                                | Yes                                   |
| California Public Retirement System .....                                | 2.00%.....                                | Yes                                   |
| California State Teachers Retirement System .....                        | 2.00%.....                                | No                                    |

Source: Gabriel, Roeder, Smith & Company

**TRS Benefit Compared to Social Security**

The original Social Security Act did not extend to state and local government workers and employers. Congress has since passed laws to allow those workers who have public pensions to elect Social Security coverage. However, state and local government workers who are covered by an adequate alternative public pension plan are not required to be covered by Social Security. Once Social Security coverage is provided, it generally cannot be terminated and all future workers are required to participate going forward. Coverage rates vary considerably across states. Across the United States, about 72.5% of state and local government workers are covered by Social Security. Currently, only 5% of public school education employees covered by the TRS plan also participate in Social Security.

In general, workers pay 6.2% of their salary to Social Security, and their employers match this amount, for a total contribution of 12.4% of salary for each covered worker. Benefits paid by Social Security are based on a worker's inflation-adjusted pay during their career and the benefits are also progressive (i.e. lower-income workers receive a relatively higher benefit than higher-income workers based on their level of contributions).

Using the Relative Benefit Index from above, Social Security as a standalone retirement benefit, would score 34% compared to the 52% score for the prototypical TRS member currently retiring. This means that the TRS plan provides a 50% greater benefit than Social Security for roughly the same contribution rate.



### III. Impacts from Potential Changes to the Current Plan

The Study charge directed TRS to report on the actuarial and fiscal impacts of potential changes to the current defined benefit plan, including changes to the: 1) retirement eligibility; 2) final average salary; and 3) benefit multiplier provisions of the plan. In examining this issue, TRS makes the following findings:

- While the TRS pension fund can pay benefits through 2075, the State needs to begin addressing the unfunded liability. Delays will only increase costs.
- Changing benefits for all current active members (not including retirees) creates the most savings for the plan.

Below, TRS addresses options to improve the funded status of the plan not only through the potential benefit changes but also through increased contributions.

#### Increased Contributions

Based on actuarial calculations, the plan's current funding policy of a 6.4% contribution from the State and a 6.4% contribution from active members is insufficient to sustain current benefits and amortize the \$24.1 billion unfunded actuarially accrued liability (UAAL), if current assumptions are met. The UAAL is the difference between plan assets and liabilities.

Moreover, while the Study charge directs TRS to examine the issues as of the August 31, 2011 actuarial valuation, TRS does have \$7.8 billion in deferred investment losses that it will recognize in future valuations, if there is no offsetting positive experience. TRS is currently preparing its August 31, 2012 actuarial valuation and has not yet calculated the ARC for FY 2013. However, taking into account the deferred losses, TRS' actuary anticipates that the contributions into the plan would need to increase by 1.5% to 2% of payroll for the plan's funded status (ratio of assets to liabilities) to reverse its decline. Furthermore, TRS's actuary anticipates that contributions would need to increase by 3% of payroll for both the funded status to reverse and for the plan to meet the definition of actuarial soundness (pay off liabilities in less than 31 years).

Figure 3.1, provides options for how the required funding could be addressed. The figure offers three patterns of contribution increases to achieve an 8% contribution from members and the state: (1) immediate increase of both member and state contributions to 8.0% as of FY 2014; (2) increase member and state contribution rates to 6.5% in FY 2014, with subsequent increases of 0.5% each year; or (3) increase member and state contribution rates to 6.5% in FY 2014 with subsequent increases of 0.25% each year. In all three scenarios:

- The member and state contribution are equal at all points of time.
- It is assumed that all assumptions are exactly met going forward.
- The current deferred asset losses of \$7.8 billion are fully recognized with no offsetting gains.

**Illustrated Options for Contribution Increases**

Figure 3.1

| Fiscal Year | Immediate Increase to 8.00% |                 | Increase of 0.5% per year |                 | Increase of 0.25% per year |                 |
|-------------|-----------------------------|-----------------|---------------------------|-----------------|----------------------------|-----------------|
|             | Rate                        | Funding Period* | Rate                      | Funding Period* | Rate                       | Funding Period* |
| 2014        | 8.0%                        | 35              | 6.5%                      | Never           | 6.50%                      | Never           |
| 2015        | 8.0%                        | 34              | 7.0%                      | Never           | 6.75%                      | Never           |
| 2016        | 8.0%                        | 33              | 7.5%                      | Never           | 7.00%                      | Never           |
| 2017        | 8.0%                        | 32              | 8.0%                      | 39              | 7.25%                      | Never           |
| 2018        | 8.0%                        | 31              | 8.0%                      | 38              | 7.50%                      | Never           |
| 2019        | 8.0%                        | 30              | 8.0%                      | 37              | 7.75%                      | 60              |
| 2020        | 8.0%                        | 29              | 8.0%                      | 36              | 8.00%                      | 41              |
| 2021        | 8.0%                        | 28              | 8.0%                      | 35              | 8.00%                      | 40              |

\*Funding Period in years based on market value of assets on valuation date at beginning of fiscal year

Source: Gabriel, Roeder, Smith & Company

Increased contributions can come from the State and/or the members; however, the longer-term pattern of revenue is more important than the amount of contributions in a single year. If a commitment to improve the plan’s funded status by an increase in revenue cannot occur in one budgetary cycle, a sustainable approach would be to take a reasonable number of years and transition into paying the ARC. Increasing contributions over a period of time may be more achievable than a full increase to the ARC in a single year, especially for active members whose take home pay would be impacted by the change. However, the cost of a transition into the higher contribution rates is a longer funding period. The 0.5% and 0.25% scenarios add approximately seven and 12 years, respectively. To offset this, the ultimate rates could be increased another 0.25% and 0.5%, respectively, which would achieve a similar funding period as the immediate increase. As shown in figure 3.1 above, many options are available for improving the status of the fund through a combination of increased member and State contributions over a period of time.

## Modified Benefits

### Changes to the Current Plan: New Hires Only

One common approach to decreasing the future liabilities of retirement systems has been to reduce the benefits for new employees. For example, in 2005 benefits were modified such that TRS members hired after August 31, 2007 have higher retirement eligibility requirements. This approach can have an impact over the long term depending on the size of the benefit reduction because future contributions that would have gone towards new benefit accruals can instead go directly towards amortizing the UAAL.

The following exhibit, Figure 3.2, provides illustrative examples of possible changes to the benefit provisions for new hires, including the impact on the contribution rates and liabilities of the plan.

**Potential Benefit Changes for New Hires Only**

Figure 3.2

| Provisions for Consideration             | Current Provisions       | Illustrated Provisions   | Cost of New Benefit Accruals | Unfunded Liability | Funding Period* | State Contribution Rate for Actuarial Soundness** | Percent of Pre-retirement Income Replaced*** |
|--|--------------------------|--------------------------|------------------------------|--------------------|-----------------|---|--|
| Current Provisions as of August 31, 2011 |                          |                          | 10.6%                        | \$24.1B            | Never           | 8.13%   | 67.8%  |
| Retirement Eligibility                   | Rule 80 & Minimum Age 60 | Rule 80 & Minimum Age 62 | 10.39%                       | \$24.1B            | Never           | 8.02%   | 67.8%  |
| Salary Averaging Period                  | 5 years                  | 7 years                  | 10.27%                       | \$24.1B            | Never           | 7.97%   | 65.2%  |
| Accrual Multiplier                       | 2.3% Per Year            | 2.0% Per Year            | 9.51%                        | \$24.1B            | Never           | 7.6%  | 59.0%  |
| Member Contribution Rate                 | 6.4% Per Year            | 7.4% Per Year            | 10.9%                        | \$24.1B            | Never           | 7.79%   | 67.8%  |

Source: Teacher Retirement System of Texas and Gabriel, Roeder, Smith & Company

### Notables:

- \*The funding period is based on a 6.4% member and State contribution rate.
- \*\*The state contribution rate is based on smoothed assets.
- \*\*\*Replacement income is based on an individual who retires at age 62 with 32 years of service.
- As the figure illustrates, changing the benefits for new hires only has no immediate or intermediate impact on the current UAAL. In fact, in some circumstances it can make the UAAL increase for a short period of time depending on the funding method used. However, all else being equal, future UAALs will be smaller when compared to current provisions.
- All changes above would be to new hires only, including changes to member contribution rates.
- The increase in the member contribution rate by 1% increases the refund liability for members who terminate service before they are vested or choose to take a refund after termination from employment. This increases the net cost to provide benefits to new hires as a significant portion of the additional revenue does not go to provide retirement benefits.

### Changes to the Current Plan: All Actives

The amount of cost savings created by modifying the benefit provisions for current members increases exponentially the closer a member is to retirement. Therefore, the larger the gap between the targeted contribution rate (presumably the ARC) and the maximum achievable contribution (what can actually be contributed), the larger the population of active employees that must be impacted by the change.

The following exhibit, Figure 3.3, provides illustrative examples of possible changes to the benefit provisions for all current active plan members, which does not include retirees. This analysis includes the effect on the contribution requirements and liabilities of the plan. Except for the retirement eligibility conditions, these changes assume all current active members are affected.

**Potential Benefit Changes for all Current Actives**

*Figure 3.3*

| Provisions for Consideration             | Current Provisions       | Illustrated Provisions   | Cost of New Benefit Accruals | Unfunded Liability | Funding Period | State Contribution Rate for Actuarial Soundness | Percent of Pre-retirement Income Replaced |
|--|--------------------------|--------------------------|------------------------------|--------------------|----------------|---|---|
| Current Provisions as of August 31, 2011 |                          |                          | 10.6%                        | \$24.1B            | Never          | 8.13%   | 67.8%                                     |
| Retirement Eligibility                   | Rule 80 & Minimum Age 60 | Rule 80 & Minimum Age 62 | 10.39%                       | \$14.7B            | 30 Years       | 6.39%   | 67.8%                                     |
| Salary Averaging Period                  | 5 Years                  | 7 Years                  | 10.27%                       | \$20.4B            | 70 Years       | 7.2%  | 65.2%                                     |
| Accrual Multiplier                       | 2.3% Per Year            | 2.0% Per Year            | 9.51%                        | \$21.9B            | 36 Years       | 6.69%   | 59.0%                                     |
| Member Contribution Rate                 | 6.4% Per Year            | 7.4% Per Year            | 10.9%                        | \$23.4B            | 69 Years       | 7.31%   | 67.8%                                     |

Source: Teacher Retirement System of Texas and Gabriel, Roeder, Smith & Company

### Notables:

- See bullets 1-3 under Figure 3.2 for assumptions on funding period, contribution rates, and replacement income.
- Changes to retirement eligibility above would impact all members not eligible to retire as of September 1, 2012. Stakeholder groups provided feedback requesting grandfather provisions for the benefit changes. In Appendix A, TRS has provided an example showing the impact of grandfathering members on the retirement eligibility change.
- Changes to the benefit multiplier would be prospective only. All members would receive a 2.3% multiplier for service prior to September 1, 2012 and 2% for all years of service after that date.
- Changes to the average salary period would have a wear-away provision so that the average salary used would be the greater of the average at the date of termination based on the new period and the average as of August 31, 2012 based on the prior averaging period.

- The impact from individual changes would be diminished when combined with other changes. For example, the savings from all changes would be less than the sum of the individual changes shown above.
- The changes in figure 3.3 are illustrative. For decision making purposes, changes in between the current provisions and the illustrated changes above can be estimated by interpolating between the values. For example, a 2.15% multiplier would be approximately the average of the 2.3% and the 2% columns.

## IV. Considerations in Plan Design

The Study charge directed TRS to examine actuarial and fiscal impacts of moving to an alternative plan, such as a defined benefit-defined contribution hybrid plan or a cash balance plan. However, before analyzing the alternative plans and associated analysis, it is useful to review the important metrics in pension plan design. In modeling alternative plans, TRS examined each plan relative to the following:

- Replacement Income;
- Plan Value; and
- Risk Balancing.

**TRS determined that the current defined benefit plan replaces roughly 68% of a career employee’s pre-retirement income... the lack of post-retirement increases will lower effective purchasing power over time.**

### Replacement Income

If a goal of a pension plan is to provide self-sufficiency in retirement that helps to mitigate against the risk of elder poverty, then the amount of retirement income received by a retiree under a particular plan is of critical importance. The most common measure for replacement income is the replacement ratio. In general, the replacement ratio is defined as the percentage of an employee’s pre-retirement income received in retirement. For example, if an employee earns an annual pre-retirement income of \$50,000 and receives an annual retirement benefit of \$35,000, then the replacement ratio is 70%.

Experts generally provide that a replacement ratio of around 70-90% is considered sufficient to maintain the standard of living prior to retirement, but it varies depending on income level.<sup>3</sup> An adequate ratio is generally recognized as one that allows retirees to maintain the same standard of living post retirement and accounts for the fact that some major expenses are eliminated in retirement, such as saving for retirement and certain taxes.

TRS determined that the current defined benefit plan replaces roughly 68% of a career employee’s pre-retirement income. As used in this Study, a career employee is defined as one who retires at age 62 with 32 years of service. The 68% replacement ratio applies only to replacement income at initial retirement, and—as demonstrated in the Relative Benefit Index of Study Section II—the lack of post-retirement increases will lower effective purchasing power over time.

A retiree’s replacement income does not have to come all from one source, such as an employer-sponsored plan. Rather, savings through all types of saving vehicles, including 401(k)-type plans, should be encouraged. Therefore, regardless of plan structure, knowledge of the replacement ratio necessary for a particular employee to maintain a pre-retirement standard of living into retirement and the amount of replacement ratio provided by an employee’s retirement plan is of considerable interest. Such information is critical for sound savings and investment decisions that impact an employee’s future.



## Plan Value

The term “value” means different things to different plan stakeholders. To TRS employers, a valuable plan is one that helps them to attract and retain quality public school and higher education employees, with the most effective plan design and cost. Taxpayers want an efficiently run plan that balances the needs of the members and the State. Members will find value in a retirement plan that fairly compensates them in retirement given the amount of compensation contributed to the plan and the amount of time spent working for their employer.

For the Study, TRS defined value as the amount of replacement ratio generated for a particular contribution rate. In other words, which plan provides the most return for the dollars contributed? This metric is also most likely to meet the aforementioned goals of the employer, taxpayers, and members.

An important component in assessing value is the amount of investment returns generated under a given plan design. The level of investment returns generated by a plan is the biggest component of value because lower investment returns necessitate higher contribution rates to provide a given level of benefits.

## Risk Balancing

There are varieties of risk in pension plan design, but the most prominent risks are investment and longevity risk. At its core, this issue asks how will the risk for securing an adequate pension benefit that the member cannot outlive be allocated between the employer and member.

A traditional defined benefit arrangement places the majority of investment and longevity risk on the employer. This is because a defined benefit plan provides a lifetime benefit that is, generally, based on a formula designed to provide a livable benefit to retirees. Alternatively, a defined contribution arrangement transitions the majority of risk to the member who must manage the plan contributions to generate adequate retirement savings. In addition to these major risks are other risks that are not as clearly defined, such as the following:

- The risk that increased employer pension contributions could be passed through to the members in the form of lower salary increases.
- The risk that individuals who retire with inadequate retirement savings could lack retirement self-sufficiency and place a strain on governmental social services.
- The risk that reduced pension benefits might cause changes in predictable retirement patterns and negatively impact younger employee recruitment.

Ultimately, there are overlapping complexities of risk that should be considered when contemplating plan design changes.

In the next section, TRS describes the alternative plans and examines them in relation to the aforementioned considerations in plan design.

## V. Alternative Plans

A defined benefit retirement plan, like TRS, delivers a lifetime stream of payments derived from a formula based on years of service, salary, and a multiplier factor. In a self-directed defined contribution plan, the employee directs the investment of an individual account and must manage the assets to ensure adequate retirement income. Between these two plan structures are a variety of plans that contain both defined benefit and defined contribution elements. For an overview of some of the peer systems using the alternative plans described below, see Appendix B.

Pursuant to the Study charge, TRS modeled alternative plans and analyzed the actuarial and fiscal impacts of those models. TRS used a number of assumptions in modeling the alternative plans, and an overview of the assumptions is provided after Figure 5.4. Additionally, a more detailed discussion of the assumptions is provided in Appendix C.

TRS modeled the alternative plans using two different approaches:

- The “Targeted Benefit Approach” keeps the ultimate level of plan benefits constant and lets the contribution amounts vary.
- The “Targeted Contribution Approach” keeps the level of contributions constant and lets the ultimate level of benefits vary.

The TRS alternative plan models demonstrate the actuarial and fiscal impacts of plan design changes on a career employee with a final salary during the last year of employment of \$45,000. This member matches very closely to a median member of TRS.

The plan designs are as follows:

### Current Defined Benefit Plan

- 2.3% benefit multiplier applied per year of service based on a final average salary period of five years.
- The cost to provide this benefit to new hires is 10.6% of payroll in total based on current assumptions.
- This plan provides 67.8% replacement ratio for a career employee.
- Using these baseline values, the Targeted Benefit Approach of the modeled plans targets a 67-68% replacement ratio for a career employee, and the Targeted Contribution Approach targets a combined 10.6% contribution rate consisting of 6.4% from the member and 4.2% from the State.
- The approach targets a 10.6% contribution rate as opposed to the 12.8% contribution rate currently being received because the cost to provide the existing TRS benefit is 10.6% with the remaining 2.2% of the State contribution going towards paying down the UAAL.

## Side by side or Parallel Hybrid Plan

- Provides a smaller defined benefit and defined contribution benefit with the goal that both benefits combined will provide adequate retirement resources.
- Investment and longevity risks are shared between the employee and employer.
- Defined benefit portion of the plan is designed to provide a lifetime annuity.
- Systems using a side by side defined benefit-defined contribution hybrid plan structure are the Georgia Employee Retirement System and Michigan Public School Employees Retirement System.
- For the Study, TRS modeled a side by side hybrid plan in which the State contribution funds the defined benefit portion of the plan and the member contribution funds the defined contribution portion of the plan with a state match. The defined benefit portion of the plan offers a 1.5% multiplier and averages the member's five highest years of salary.

## Capped Hybrid Plan

- Similar to the side by side defined benefit-defined contribution hybrid plan, but the employer contribution is capped at a fixed percentage of pay.
- Plan design can split the capped contribution between the defined benefit and defined contribution plans based on actuarial factors. However, the employer's contribution does not increase beyond the cap.
- The Utah Retirement System utilizes this alternative plan.
- For the Study, TRS modeled a capped hybrid plan in which the State contributes a set percentage of the member's pay towards the ARC of the defined benefit portion of the plan. If the State contribution is greater than the ARC, then the difference between the contribution and the ARC goes towards the defined contribution portion of the plan. If the State contribution is less than the ARC, then the member contribution must make up the difference between the State contribution and the ARC.

## Cash Balance Plan

- Members have a "virtual" account to which both the employer and the member contribute a set percentage of wages (pay credits).
- Pay credits then earn interest at an amount specified in the plan (interest credits).
- Interest credits can be handled in various ways. For example, a set rate of interest credit, such as 5%; an interest credit tied to a yield index at a specific point in time (treasury yields, corporate bonds, etc); or a credit based on the actual performance of the trust fund. Minimums and maximums can be applied along with applying a factor to the credit. For example, the credit could be 2% plus 50% of the actual return of the fund. How the investment credit is formulated dictates how much risk is shared between the member and the State.
- State and member share investment and longevity risk.
- Systems using a cash balance plan are the Texas Municipal Retirement System and the Nebraska Public Employees Retirement System.
- For the Study, TRS modeled a "100% pass through cash balance plan" where the member's virtual account is credited with the actual investment return on the underlying asset, determined by a five-year smoothed basis. Therefore, the member holds the majority of investment risk during active employment.



### **Cash Balance Plan Cont.**

- Virtual account can be converted to an annuity at retirement or other options may be made available. As modeled, the account balance is annuitized into the trust fund based on a 5% discount rate and plan mortality. Annuitizing the plan in this manner means that the State continues to be exposed to the longevity risk and to the investment risk post-employment.

### **Self-Directed Defined Contribution Plan**

- Traditional defined contribution plan design.
- Member and/or State contribute money to the account.
- Member selects the investments from a list of options provided by the plan.
- Member assumes virtually all of the investment and longevity risk.
- The State would have no involvement in investing or administering the plan.
- For the Study, TRS assumed that the member would self-direct investment of the contributions and annuitize the balance with a private insurance company at retirement.

### **Pooled Defined Contribution Plan**

- Similar to a self-directed defined contribution plan in which the contributions from the member and State are set and the member is responsible for managing the assets after retirement.
- During active employment, however, the assets are professionally invested and managed by the retirement system. This can be done in a variety of ways from offering allocation options based on the member's desired retirement date and risk preferences to removing the investment decisions from the individual member altogether.
- At retirement, the member must remove the money in a lump sum or roll the money into another retirement plan or Individual Retirement Arrangement (IRA).
- For the Study, TRS assumed that the member would not be involved in investment of the contributions during active employment and would annuitize the balance with a private insurance company at retirement.

TRS examined each of the alternative plan models for the level of replacement ratio provided, the plan value offered, and the balance of risk. Following is a discussion of how the different plans compared under these metrics.

## Replacement Income and Value

In examining replacement income, TRS finds that the defined benefit plan:

- Provides current benefits at a lower cost than alternative plans.
- Provides a higher benefit to the career employee for the current contribution than any of the alternative plans.

The defined benefit plan provides current benefits at a lower cost than alternative plans and provides a higher benefit for the current contribution than any of the alternative plans.

The study finds that the existing defined benefit plan provides the current level of benefits at a lower cost than alternative plans. Therefore, if the State desires to provide the same levels of benefits under an alternative plan, then higher contribution rates would be necessary.

Figure 5.1 demonstrates this finding. TRS set the cost of the current defined benefit plan at a cost of 100 (not including the cost to amortize any unfunded liability) and measured the relative cost of the alternative plans with the goal of providing the same benefit level to a career employee as provided under the current plan.

Figure 5.1

| Comparison of Alternative Plans         |                    |                     |               |                          |       |       |
|---|--------------------|---------------------|---------------|--------------------------|-------|-------|
| Targeted Benefit Approach               |                    |                     |               |                          |       |       |
| Illustrated Structure                   | State Contribution | Member Contribution | Relative Cost | Replacement Ratio at Age |       |       |
|   |                    |                     |               | 60                       | 62    | 65    |
| Current Defined Benefit Plan            | 4.2%               | 6.4%                | 100           | 63.6%                    | 67.8% | 74.2% |
| Side by Side Hybrid Plan                | 9.4%               | 6.4%                | 149           | 62.8%                    | 68.2% | 77.0% |
| Capped Hybrid Plan                      | 9.4%               | 6.4%                | 149           | 62.8%                    | 68.2% | 77.0% |
| Cash Balance Plan                       | 5.42%              | 6.4%                | 112           | 58.1%                    | 67.5% | 84.5% |
| Pooled Defined Contribution Plan        | 10.9%              | 6.4%                | 163           | 58.6%                    | 67.8% | 84.3% |
| Self-Directed Defined Contribution Plan | 18.89%             | 6.4%                | 238           | 59.9%                    | 67.6% | 80.3% |

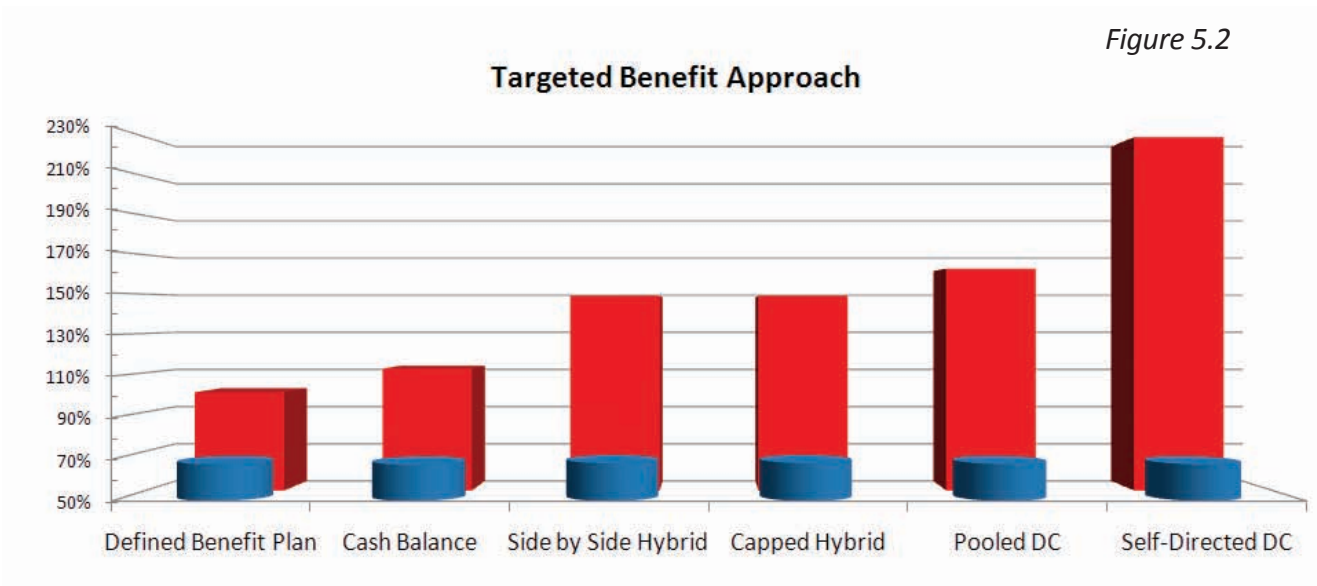
Source: Teacher Retirement System of Texas and Gabriel, Roeder, Smith & Company

One of the features of the traditional defined benefit plan is that it maximizes the reward to career employees over short-term employees. Defined contribution plans, on the other hand, provide an even reward to all employees over the course of their employment. To provide the same benefit to the career employee, it takes significantly more contributions across all employees. Replacement ratio and cost across the structures show the difference in value between the plan designs. This difference includes not only the differences in economic efficiencies in delivering benefits to a specific individual but also the efficiency of delivering the most value to career employees.

**Notables:**

- The Targeted Benefit Approach is designed so that all of the structures create a 67-68% replacement income at age 62.
- The relative cost always refers back to the current benefit structure. So the 238 score on a self-directed defined contribution plan means that it costs 138% more across all members to provide the same benefit at retirement to career employees, if all assumptions are met.
- The beginning costs of the two hybrid plans are the same. Any variance will be when the experience differs from the assumptions. This is illustrated in the investment return sensitivity analysis of Appendix D.
- The cash balance plan, as designed, can provide most of the efficiencies of the current defined benefit plan. In fact, the cost of providing the retirement benefit to the median member who retires under the system is the same. The increased cost from the cash balance plan comes from the increased portability to members who do not retire under the system and from those members that work past the targeted retirement age and receive a significantly larger benefit.

Figure 5.2 is a graphical representation of the Targeted Benefit Approach. The figure shows the contribution rate (relative cost) necessary under each plan structure when the benefit level is kept the same and the contribution rate varies.



Source: Teacher Retirement System of Texas and Gabriel, Roeder, Smith & Company

Figure 5.3 shows the replacement income results of the alternative plans as modeled under the Targeted Contribution Approach. With this approach, the cost of each plan is held equal to the cost of the current defined benefit plan (not including the cost to amortize any unfunded liability) and the resulting replacement ratios are allowed to vary. The result of the Targeted Contribution Approach shows that the current defined benefit plan provides a higher benefit for the current cost than any of the alternative plans.

Figure 5.3

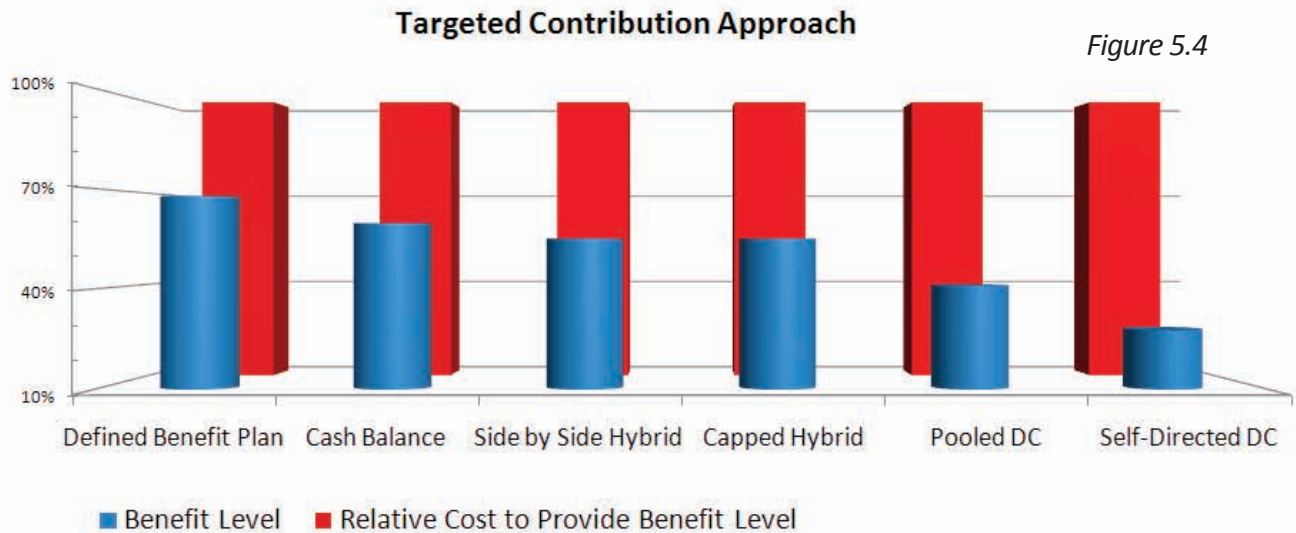
| Comparison of Alternative Plans         |                    |                     |               |                          |       |       |
|---|--------------------|---------------------|---------------|--------------------------|-------|-------|
| Targeted Contribution Approach          |                    |                     |               |                          |       |       |
| Illustrated Structure                   | State Contribution | Member Contribution | Relative Cost | Replacement Ratio at Age |       |       |
|   |                    |                     |               | 60                       | 62    | 65    |
| Current Defined Benefit Plan            | 4.2%               | 6.4%                | 100           | 63.6%                    | 67.8% | 74.2% |
| Side by Side Hybrid Plan                | 4.2%               | 6.4%                | 100           | 51.1%                    | 55.1% | 61.3% |
| Capped Hybrid Plan                      | 4.2%               | 6.4%                | 100           | 51.1%                    | 55.1% | 61.3% |
| Cash Balance Plan                       | 4.2%               | 6.4%                | 100           | 51.4%                    | 59.7% | 74.8% |
| Pooled Defined Contribution Plan        | 4.2%               | 6.4%                | 100           | 35.4%                    | 40.9% | 50.9% |
| Self-Directed Defined Contribution Plan | 4.2%               | 6.4%                | 100           | 24.7%                    | 27.7% | 33.1% |

Source: Teacher Retirement System of Texas and Gabriel, Roeder, Smith & Company

**Notables:**

- Using the Targeted Contribution Approach, notice that all of the structures create a 100 relative cost. The beginning costs of the two hybrid plans are the same. Any variance will be when the experience differs from the assumptions as shown in Appendix D.
- As modeled, the cash balance plan offers the closest replacement ratio to the current plan at age 62 and a slightly greater replacement ratio than the current plan at age 65.
- The 27.7% expected replacement ratio for the self-directed defined contribution plan at age 62 equates to a \$12,500 annual benefit for the career employee, with no anticipated cost of living adjustments and no Social Security benefits. For reference, the poverty guideline in 2011 for a household of one was \$11,170.
- The approach targets a 10.6% contribution rate as opposed to the 12.8% contribution rate currently being received because the cost to provide the existing TRS benefit is 10.6% with the remaining 2.2% of the State contribution going towards paying down the UAAL.

Figure 5.4 is a graphical representation of the Targeted Contribution Approach. The Figure shows the resulting replacement ratio under each plan structure when the contribution rate is kept the same and the benefit is allowed to vary.



Source: Teacher Retirement System of Texas and Gabriel, Roeder, Smith & Company

The other major assumptions TRS used to model the alternative plans are as follows:

- Rule of 80 with minimum age 60 retirement eligibility for all plans.
- 6.4% member contribution rate in all plans.
- Five-year cliff vesting in all plans, which is consistent with the current plan.
- No post-retirement benefit increases in all plans.
- 8% annual investment return, net of expenses, for the defined benefit portions of the hybrid plans.
- 5.3% annual investment return, net of expenses, for the defined contribution portions of the hybrid plans and the self-directed defined contribution plan.
- 7.8% annual investment return, net of expenses, for the pooled defined contribution plan.
- Annuitization of all defined contribution plan balances with a private insurance company at retirement (in order to generate replacement ratios), which entails a 5% discount rate, and a 10% load on mortality for margin, administration, commission, and profit.
- The actuarial calculations, representations and terminology presented in this Study are in compliance with the Government Accounting Standards Board (GASB) Statements currently in effect. The GASB has recently adopted two new Statements, GASB Statement 67 Financial Reporting for Pension Plans and Statement 68 Accounting and Financial Reporting for Pensions, which when effective for Texas’ State Fiscal Years 2015 and 2016 respectively, will provide new accounting guidance for Pension Plans and Employers. The new guidance revises the way pension liabilities must be calculated and presented for financial reporting purposes. They do not impact the way pension systems are funded by a governmental body.

## Investment Returns as a Component of Value

It is important to understand why the alternative plans modeled by TRS are more expensive than the current defined benefit plan to provide the same level of benefits. The main reason for the expense difference is that most alternative plans do not generate the same level of investment returns as the defined benefit plan. Additionally, the portability that comes with the cash balance plan and the lump-sum distribution feature of the pooled defined contribution plan add to the extra expense of those structures. In examining the projected investment performance of the alternative plans, TRS concludes that:

**The spread of returns earned by TRS members investing on their own would likely be very wide... modeling showed that two-thirds would receive no more than 60% of the current benefit. Only a handful (about 8%) of the members would receive more than the current defined benefit.**

- Over 90% of TRS members will do significantly worse investing on their own in a plan with a defined-contribution component.
- The underperformance of alternative plans with defined contribution elements is primarily due to access to fewer asset classes, demonstrated behavioral tendencies by individuals, and potentially higher fees.

The return of the TRS system over the past 25 years has been 8.6%<sup>4</sup>. By comparison, if TRS members were asked to invest as individuals, their net investment return is estimated at 5.3%. Detailed information regarding how TRS determined the net investment return for members investing on their own, including the impact of access to fewer asset classes, behavioral tendencies, and potential payment of higher fees is found in Appendix E. Below is an overview of these concepts.

Through its modeling, TRS determined that the spread of returns earned by TRS members investing on their own would likely be very wide. TRS compared the amount of annuity a career employee could purchase with the defined contribution returns from a private insurance company at retirement to the annuity a career employee would receive under the current defined benefit plan. TRS found that for 92% of possible outcomes, the defined benefit annuity exceeds the defined contribution annuity. Additionally, modeling showed that two-thirds would receive no more than 60% of the current benefit. Only a handful (about 8%) of the members would receive more than the current defined benefit. Income replacement therefore would be a significant issue for many TRS members.

As mentioned above, the lower returns members are expected to achieve in a defined contribution plan or a defined contribution component of a hybrid plan are due to access to fewer asset classes, demonstrated behavioral tendencies, and potential payment of higher fees.



### Access to Fewer Asset Classes

One reason an institutionally managed system, like TRS, is anticipated to outperform individual investors is access to asset classes that are offered to qualified institutional investors. These asset classes include private equity and private real estate, which provide essential diversification and return enhancement to the TRS portfolio. As shown in Figure 5.5, two of the nation’s largest lifecycle fund families, Vanguard and Fidelity, lack exposure to the following TRS asset classes in their lifecycle funds:<sup>5</sup>

Figure 5.5

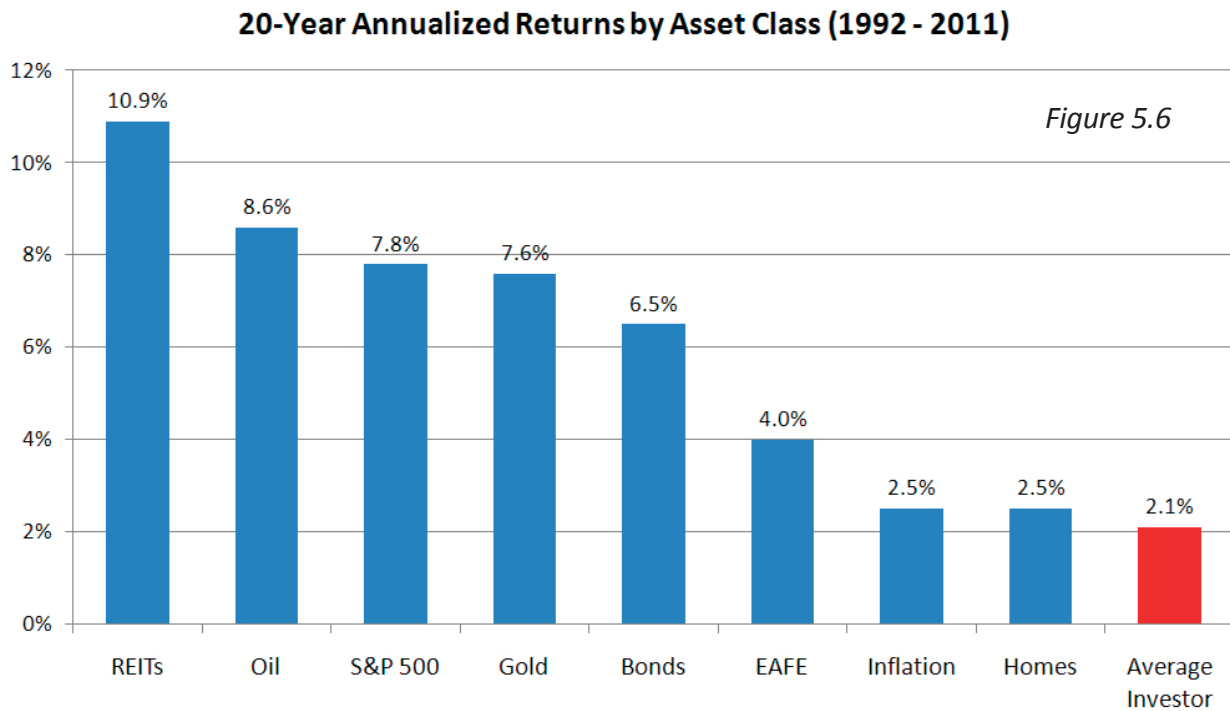
| Asset Class Access Comparison |     |                        |  |                                  |
|-------------------------------|-----|------------------------|--|----------------------------------|
| Asset Class                   | TRS | Fidelity Freedom Funds |  | Vanguard Target Retirement Funds |
| Large Cap Value               | Yes | Yes                    |  | Yes                              |
| Large Cap Growth              | Yes | Yes                    |  | Yes                              |
| Small Cap                     | Yes | Yes                    |  | Yes                              |
| EAFE                          | Yes | Yes                    |  | Yes                              |
| Emerging Markets              | Yes | Yes                    |  | Yes                              |
| Directional Hedge Funds       | Yes | No                     |  | No                               |
| Private Equity                | Yes | No                     |  | No                               |
| Stable Value Hedge Funds      | Yes | No                     |  | No                               |
| Long Treasuries               | Yes | No                     |  | No                               |
| Cash                          | Yes | Yes                    |  | Yes                              |
| US Aggregate                  | Yes | Yes                    |  | Yes                              |
| US TIPS                       | Yes | Yes                    |  | Yes                              |
| REITS                         | Yes | Yes                    |  | No                               |
| Commodities                   | Yes | Yes                    |  | No                               |
| Real Assets                   | Yes | No                     |  | No                               |

Source: Teacher Retirement System of Texas

TRS and other defined benefit plans capture additional return, increased diversification, and enhanced risk management by investing in less liquid assets such as private equity and private real estate. For instance, over the three years to June 30, 2012, TRS earned an annualized 18.5% return on its investments in private equity, compared to an 11.1% return on its investments in public equities.

**Demonstrated Behavioral Tendencies**

Figure 5.6 is J.P. Morgan’s recent report on returns earned by individuals (as a group) relative to asset class returns over a 20-year period.<sup>6</sup> The chart demonstrates that individual investors have generated lower returns over the last 20-year period than if they had invested consistently in any of the asset classes shown on the figure.



Source: JPM Guide to the Markets, Q3 2012.

**Federal Thrift Savings Plan**

In 1986, an investment program was created for U.S. federal government employees and now totals \$317 billion in aggregate assets as of year-end 2010. The options offered, the options selected, and the implementation used is instructive. Based on its most recent report, nearly 50% of invested money is allocated to lower return investment strategies, particularly government bonds.<sup>7</sup> Other options are either generic equity indices (U.S. Stocks, International Developed Market Stocks, etc.) or a series of lifestyle funds. Essentially all implementation is via passive index funds or “special” government bonds. Efforts to date to reduce the behavioral biases among individual investors, primarily by the inclusion of lifestyle funds, seem to have largely failed as just 11% of assets are invested in this manner.<sup>8</sup> The projected investment returns for Federal Thrift Savings Plan participants is currently 5.3% over the long-term (using the assumptions cited in Appendix E).

**Payment of Higher Fees**

Finally, as further discussed in Appendix E, TRS used market data in order to ascertain the impact of fees and expenses on individual investors. Based on information from the Government Accounting Office, Investment Company Institute, and TRS actual costs, TRS estimates annual investment expenses for individual investors at 89 basis points. Conversely, TRS pays 47 basis points annually, which includes all internal TRS investment costs and the cost of all external investment managers.<sup>9</sup>



## Risk Balancing of the Alternative Plans

In analyzing the issue of risk under the alternative plans, TRS determined the following:

- Alternative plan structures carry differing levels of risk for the State and TRS members.
- In practice, however, neither the employer nor the member can completely avoid the risks associated with ensuring retirement security.

TRS examined each of the alternative plans to ascertain how plan design affects risk balancing. There are varieties of risk in pension plan design, but the biggest concerns are investment risk and longevity risk. Investment risk is the risk of actual investment returns falling short of assumptions, which includes the impact of market volatility. Longevity risk is the danger that a retiree will outlive his or her retirement savings. Related to this risk is the concern that an individual will not be able to maintain retirement self-sufficiency and end up relying on public services for his or her needs.

In the current defined benefit plan the State bears the investment risk and is responsible for ensuring that, either through contributions or investment returns, there are sufficient funds to provide a retiree’s lifetime benefit. This risk, however, is mitigated because longevity risks are pooled (i.e., averaged) over all the plan members (employees, retirees, and their beneficiaries).

Alternatively, a defined contribution plan transitions the majority of risk to the member who must invest the plan contributions to generate adequate retirement savings that will last the member’s lifetime (as opposed to average life expectancy).

The alternative plans in between the current defined benefit plan and the defined contribution plan share these risks between the State and the members in different ways.

### Defined Benefit-Defined Contribution Hybrid Plans

- Investment and longevity risks are borne by the State on the defined benefit portion of the plan.
- Investment and longevity risks are borne by the member on the defined contribution portion of the plan.
- In the capped hybrid plan, however, the State’s exposure to investment and longevity risks is limited, even in the defined benefit portion of the plan. This is because the State contribution is capped, and if assumptions are not met, the member must make any contributions needed above the State cap to keep the plan actuarially sound.

### Cash Balance Plan

- Investment and longevity risks are borne primarily by the member during the member’s active employment. However, because the State guarantees a level of investment credit during active employment, the State does have some exposure to investment risk.
- Investment and longevity risks are borne by the State once the member retires and the balance of the member’s “virtual account” is annuitized into the trust fund.

**Other Risk Considerations**

In practice, however, neither the employer nor the member can completely avoid the risks associated with ensuring retirement security. For example, with defined benefit plans, increases in employer pension contributions are often indirectly passed to the active members by decreases in other forms of compensation. Likewise, if investment return assumptions are not met in a defined benefit plan, the employer—who traditionally bears the investment risk—can mandate member contribution increases to mitigate some of the investment losses. Conversely, members who make poor investment choices or do not save enough in a defined contribution plan will likely have to continue working past the point of normal-age retirement. The employer could eventually realize reduced productivity and performance from employees who are forced to keep working for financial reasons many years past their desired retirement age. This could also delay the advancement of younger workers.

An additional risk consideration is the impact of market volatility on savings. The following table shows that just two years can equate to vastly different retirement outcomes for an individual, especially if they cannot rely on Social Security as an income source.

**60/40 Portfolio Loss Compared to 2 Years Prior**

| Year of Retirement | Loss |
|--------------------|------|
| 1974               | 43%  |
| 1980               | 16%  |
| 2002               | 21%  |
| 2008               | 23%  |

*Figure 5.7*

Source: TRS Analysis. Historical inflation-adjusted returns assuming \$1 per year invested for prior 25 years in a portfolio composed of 60% stocks and 40% US Long Treasury Bonds. CPI, S&P 500 Total Return, and US Treasury Return (Shiller and Barclays).

Furthermore, in plans with a defined-contribution component, retirees are subject to timing risk should they wish to convert their retirement savings into an annuity. Being subject to interest rate risk at the point of annuitization means the same retirement balance may result in a much smaller annuity based on the market interest rate.

Ultimately, if members retire without adequate income or if retirees experience a drastic reduction in their savings post-retirement, then state and local governments may face growing demands on programs such as food stamps, Medicaid, and other social services. This potential outcome shifts some of the investment and longevity risk back to the State and taxpayers. The fiscal and social costs resulting from retirees who lack retirement self-sufficiency are beyond the scope of this study to assess but could be significant. Therefore, while changing to an alternative plan could shift direct investment and longevity risk away from the State, it is important to consider the potential impacts that could come from shifting these risks.

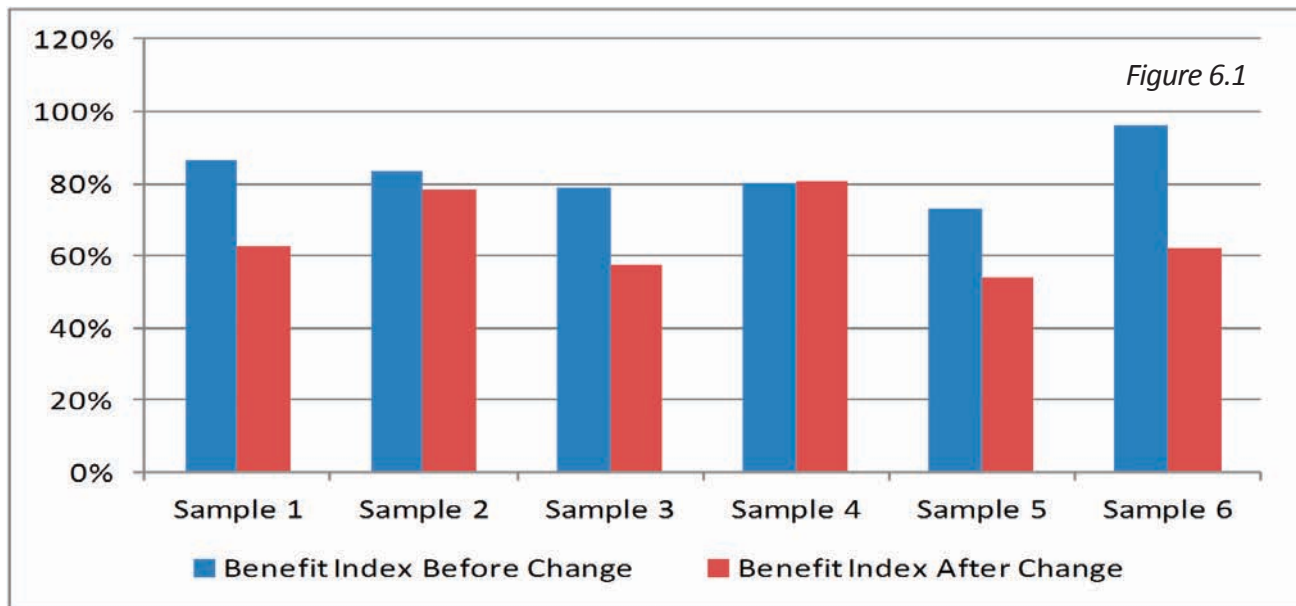
## VI. Ways Plans Engender Savings

The results of TRS' modeling suggest that while changes in plan structure may shift risk from the employer to the member, they do not engender savings. This, then, raises the question of how plans have achieved savings if not through structural changes. In examining the issue, TRS has determined as follows:

- Other states changing plan structures have lowered benefits to realize savings.
- While there are cost savings measures available to the TRS plan (such as the options shown in Figures 3.2 and 3.3), the plan already incorporates the main cost-savings measures undertaken by other states.

First, TRS examined whether plans that undergo structural changes (e.g. moving from a defined benefit plan to an alternative plan) also reduce benefits as part of the change to achieve savings. TRS analyzed six statewide plans that recently changed structures to determine if benefits were lowered as part of the structural change, and if so, to what extent. TRS determined that the six plans examined lowered benefits provided by the employer-sponsored system by 30% as part of moving to an alternative plan. The employer-sponsored system would include any defined contribution portion of the retirement plan. Figure 6.1, provides the relative benefit index calculated for each program before and after the change. One plan appears to be an outlier in the amount of benefit reduction, but in fact the member contribution rate was increased by 4.5% to maintain the level of benefit. Notice that in all of the sample alternative structures, the relative benefit index of the new, lower benefit structure is still larger than the 52% index value of the current TRS plan shown in Study Section II.

### Benefit Value Before and After Plan Structural Changes



The six plans sampled were Georgia Employees Retirement System, Kansas Public Employees Retirement System, Louisiana State Employees Retirement System, Michigan Public School Employees Retirement System, Rhode Island Employees Retirement System, and Utah Retirement System.

**Plans do not achieve savings by simply moving to a different structure. Rather, a benefit reduction must accompany such a move in order for the plan to realize savings.**

The results of Figure 6.1 reinforce the finding from the Targeted Benefit Approach because both indicate that plans do not achieve savings by simply moving to a different structure. Rather, a benefit reduction must accompany such a move in order for the plan to realize savings.

Second, TRS examined which benefit reductions were most common in other states to determine if such reductions were options for TRS. In May 2012, the National Association of State Retirement Administrators (NASRA) published “Selected Approved Changes to State Public Pensions to Restore or Preserve Plan Sustainability.”<sup>10</sup> In the publication, NASRA compiled the major changes in contributions, benefits, and eligibility undertaken by 44 retirement systems for 2010 and 2011. In examining the NASRA publication, TRS found the following:

- 41% of the plans eliminated, reduced, or froze their automatic COLAs to achieve savings. This was the single most common change. The TRS plan does not include an automatic COLA.
- 20% of the plans increased from a three to a five-year final average salary benefit provision. The State increased the TRS final average salary provision from three to five years in 2005 with some grandfathering for members who were close to retirement.
- 18% of the plans increased the actuarial reduction for early retirement. In 2005, the State strengthened the requirements for retirement eligibility by providing that members who join TRS after August 31, 2007 must be at least age 60 and meet the rule of 80 to retire without an actuarial reduction of up to 5% per year for each year below age 60.

Therefore, while there are options for TRS to reduce benefits and engender savings, the TRS plan already addresses many of the cost-saving measures being undertaken by other states.

## VII. Addressing the Unfunded Liability

Previously, TRS examined the cost of alternative plans as compared to the cost of the current plan. That examination was based on the cost of accruing new benefits and did not address the cost to pay down the existing unfunded liability. In examining the impact of the alternative plans on the existing unfunded liability, TRS finds the following:

- The State cannot eliminate the unfunded liability by moving new hires into an alternative plan.
- “Closing” the current plan by moving new hires to a defined contribution plan would increase the unfunded liability by \$11.7 billion due to higher cash flow needs.

**The current unfunded liability does not represent any prospective liability for anticipated new hires. Therefore, the State cannot eliminate the unfunded liability by placing new hires into an alternative plan.**

In the Study, TRS has modeled a variety of options for alternative plans. The actuarial impact of an alternative plan on the existing liability depends largely on the policy decisions made by the State, including the following two threshold issues:

- Is the alternative plan only for new hires or all current active members?
- Is the current plan “open” or “closed?”

### **Is the Alternative Plan Only for New Hires or All Current Active Members?**

The current unfunded actuarially accrued liability of \$24.1 billion on a smoothed value of assets basis (\$32.0 billion on a market value of assets basis) represents benefits accrued by current active members and retirees. It does not represent any prospective liability for anticipated new hires that have not yet joined the system. Therefore, the State cannot eliminate the unfunded liability by placing new hires into an alternative plan.

The existing accrued liability does take into account projected retirement eligibilities and projected future salary increases for existing active members (but not ad-hoc COLAs for existing retirees). Considering the liability does include these projections, moving all current active members (not including retirees) to an alternative plan going forward could, potentially, reduce the UAAL. However, the actuarial impact of such a move would depend on the type of alternative plan selected and the implementation of any plan changes. Given that there are major policy questions to answer before TRS can estimate the impact of moving current active members, this Study examines only the impact of placing new hires into an alternative plan. With direction from the State on the associated variables, TRS could examine the impact of moving current active members into an alternative plan.

## Is the Current Plan “Open” or “Closed”?

Using the assumption that active members stay in the current defined benefit plan, TRS examined the impact on the UAAL of moving new hires into an alternative plan. In its examination, TRS has determined the following:

- Placing new hires into a defined benefit-defined contribution hybrid plan or cash balance plan would keep the current plan “open,” which has no impact on the UAAL.
- Placing new hires into a defined contribution plan would “close” the current plan and increase the UAAL by \$11.7 billion due to lowering of future expected investment earnings.

When a member is hired, contributions from the member and the State are made into the trust fund and invested. These are cash inflows. Then, once the member retires decades later, the benefits are paid as cash outflows. A plan is considered “open” if cash inflows from the alternative plan can be used to meet the cash outflow needs of the current plan. Conversely, a plan is “closed” when the cash inflows are not available to meet the current plan’s outflow needs. The type of alternative plan selected by the State dictates whether the current plan is open or closed.

If the State were to adopt a defined benefit-defined contribution hybrid plan or a cash balance plan, then the current plan would be open because even though new members would accrue benefits under an alternative plan, all contributions would go into the current trust fund to be invested. Conversely, in a defined contribution plan, the current plan would be closed. This is because contributions would be credited to the member’s account to be invested either directly by the member or by TRS and would not go into the current trust.

The distinction matters because adopting an alternative plan that “closes” the current plan will lower the cash inflows much sooner than it will decrease the cash outflows. For example, in FY 2011, there were \$4.7 billion in contributions made into the trust fund and \$7.6 billion in benefits and refunds paid from the trust fund. This meant that the trust fund itself only had to absorb the difference of \$2.9 billion, or approximately 2.9% of the average invested assets. This level of need can likely be met by interest, dividends, and the natural purchasing and selling of securities.

However, if the State closed the plan, then the percentage of cash outflows would increase substantially. For example, the benefit payments paid out of the trust over the first five years would decrease by approximately \$275 million. However, the total contributions over that same period would decrease by approximately \$2.1 billion. Therefore, current trust assets would be used to fund \$1.8 billion more during the first five years than under an open plan. For years 6 through 10, the cash inflows would be projected to decrease by \$7.5 billion while the net outflows would have decreased by only \$0.8 billion, putting \$6.7 billion more responsibility on the trust assets.

Higher negative cash flow positions can impact the trust's ability to generate investment earnings by causing the following:

- Reducing the ability of the trust fund to invest in less liquid assets. These assets, such as private equity and real estate, historically have produced higher long-term returns, and lowering this allocation would lower the fund's overall expected return.
- Increasing the trust's immediate cash needs, thus forcing the asset allocation more towards more liquid but shorter-term lower returns.
- Reducing the amount of risk (volatility) that can be borne by the investment portfolio, and pushing the trust towards a more conservative asset allocation, which is expected to produce lower returns. For example, if the plan were closed today, there will still be an estimated \$188 billion in trust assets in FY 2041. A 10% drawdown of assets at that time would be approximately \$19 billion and would have to be financed over a very short period of time because only retirees would remain in the plan. This level of need requires more liquidity and may require a different asset allocation than the current plan.

To estimate the loss of future investment earnings on trust assets, TRS has projected that the assumed investment returns going forward under a closed plan would eventually be approximately 0.80% lower (a 7.2% investment return after the multi-year transition) than would be produced by the current open plan, which—as shown in Figure 7.1—results in an \$11.7 billion increase to the current UAAL.

How the additional \$11.7 billion liability is addressed depends on the funding policies adopted by the State. TRS does not assert that the State must pay the entire amount of the UAAL immediately. However, the timeline for the payoff will be accelerated compared to the current 30-year rolling amortization policy because the UAAL must be fully paid by the date the last beneficiary in the closed plan stops receiving benefits.

If the State moves to a defined benefit-defined contribution hybrid plan or cash balance plan, then the current plan could be considered open. With this change, there would be no effect on the existing UAAL. First, the UAAL will not decrease because, as stated above, new hires are not part of the current liability. Second, the UAAL will not increase because new contributions would flow into the same investment pool, and all benefits would be paid from the same trust. It is important to note that for the defined benefit-defined contribution hybrid plans, the total contributions into the trust would decrease given that a portion of the contributions would go towards the defined contribution portion of the plan. Therefore, net cash flow needs would increase over time and this could result in some level of reduced future expected investment earnings. Overall, however, TRS assumes that moving to a hybrid design will not necessitate a significant change in asset allocation.



Figure 7.1 compares keeping the plan open with a cash balance or hybrid plan for new hires to treating the plan as if it were closed with a defined contribution plan for new hires. The illustrated valuation is as of August 31, 2011, and the variable is the anticipated 7.2% investment return for a closed plan compared to the current 8% assumption.

Figure 7.1

| Snapshot as of August 31, 2011 Showing the Impact of an “Open” vs. “Closed” Plan |                               |                            |          |
|--|-------------------------------|----------------------------|----------|
| Alternative Plan Structure   | Hybrid and Cash Balance Plans | Defined Contribution Plans | Change   |
| Is the Plan “Open” or “Closed”   | Open                          | Closed                     | N/A      |
| Assumed rate of Return   | 8.00%                         | 7.20%                      | -0.80%   |
| Market Value of Assets   | \$107.4 billion               | \$107.4 billion            | N/A      |
| Smoothed Value of Assets   | \$115.2 billion               | \$115.2 billion            | N/A      |
| Actuarial Accrued Liability  | \$139.3 billion               | \$151.0 billion            | \$11.7 B |
| Actuarially Accrued Unfunded Liability   | \$24.1 billion                | \$35.8 billion             | \$11.7 B |
| Funded Ratio   | 82.7%                         | 76.3%                      | -6.4%    |
| Funding Period (based on a 6.4% member and state contribution rate)              | Never                         | Never                      | N/A      |
| Normal Cost  | 10.60%                        | 13.02%                     | 2.42%    |
| Employer 30-Year ARC From the State (based on 6.4% member contribution rate)     | 8.13%                         | 11.98%                     | 3.85%    |

Source: Teacher Retirement System of Texas and Gabriel, Roeder, Smith & Company



## VIII. The Social Security Factor

As discussed in Study Section II, at its inception Social Security was not extended to public sector employees such as teachers. Once Social Security coverage was offered to public employees, it initially was left up to the state or local government employer to elect participation. Even now, with participation mandatory for virtually all employees, many state and local government employees remain exempt as long as they participate in an acceptable replacement retirement plan such as TRS. As a result, only 5% of public school employees in TRS and 20% of all active TRS members participate in Social Security. The exemption from Social Security coverage due to TRS participation saves Texas public school employers an estimated \$1.5 billion annually. Therefore, TRS finds the following are important considerations for the State when weighing changes to the plan:

**95% of public school TRS members do not participate in Social Security, leaving the TRS benefit as their only lifetime annuity.**

- 95% of public school TRS members do not participate in Social Security, leaving the TRS benefit as their only lifetime annuity.
- If benefit changes triggered mandatory Social Security participation, then the 6.2% Social Security contribution might have to be made in addition to the 6.4% member and State contributions to the TRS plan, given that the TRS plan is constitutionally mandated.

A lifetime benefit, such as the TRS annuity or Social Security, mitigates against longevity risk because it provides a formula-based benefit that an employee cannot outlive. If most TRS members do not have Social Security and plan structural changes leave them with only a defined contribution plan, then most would face retirement without any lifetime benefit. Therefore, a TRS member who—either due to the luck of the markets or a lack of savings—fails to generate adequate retirement savings could outlive retirement funds and have no lifetime benefit on which to rely. Most TRS members, then, would lack the retirement security of a lifetime benefit enjoyed by most others who retire from public and private service.

Additionally, it is important to note that, for a state or local government employee to continue to be exempt from Social Security coverage, the employee must participate in a public retirement system that meets certain federal law safe harbor requirements. Under federal law, a plan meets the safe harbor if it meets the following:<sup>11</sup>

- If the plan is a defined contribution plan, it must provide for a mandatory minimum allocation to the employee’s account of at least 7.5% of the employee’s compensation. The 7.5% may be made up of employer-only, employee-only, or both employer and employee contributions.
- A defined contribution plan must credit employees’ accounts with a reasonable interest rate or the accounts must be held in a separate trust subject to fiduciary standards and credited with actual earnings.
- If the plan is a defined benefit plan, it generally meets the safe harbor if the benefit is at least 1.5% of average compensation during an employee’s last three years of employment, multiplied by the employee’s number of years of service. A plan that uses a five-year salary average must use a multiplier of at least 1.6%. The plan must offer a single life annuity payable beginning no later than age 65.

If structural changes or benefit reductions cause the TRS benefits to fail to meet the safe harbor provisions, then all Texas public education employers might be forced into Social Security. This means that both the members and the employers would have to contribute 6.2% of the employee’s pay to the federal program. An additional consideration is that this contribution might have to be made in addition to member and State contributions to the TRS plan, given that the TRS plan is constitutionally mandated.

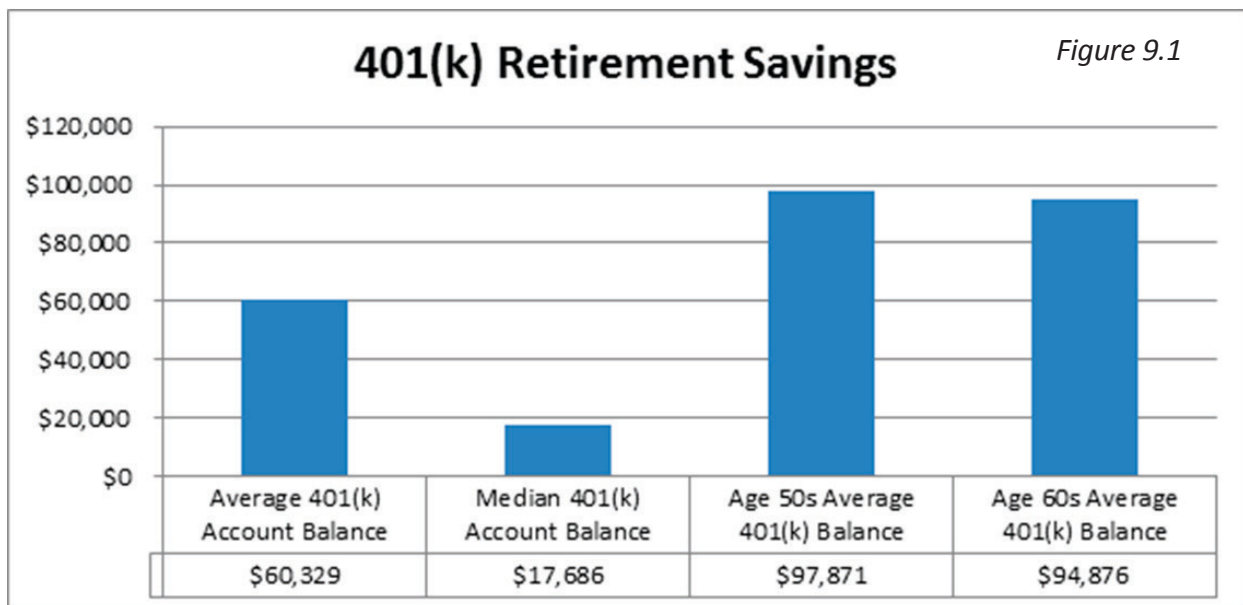
The Study does not attempt to determine whether the State constitutionally could opt for Social Security coverage instead of maintaining the TRS plan. Rather, TRS simply raises the policy consideration that the State could find itself contributing to the TRS plan and addressing the fact that school districts might have to pay for mandatory Social Security coverage of their employees, if TRS benefits were to fall below the safe harbor.

## IX. Other Policy Considerations

### Personal Savings

Another important consideration when examining potential plan changes is the fact that individuals saving for retirement in self-directed defined contribution plans are largely unprepared for retirement. According to the Employee Benefit Research Institute, a majority of American families have less than \$25,000 saved for retirement (outside of the value of their homes and defined benefit plans).<sup>12</sup> As demonstrated in Figure 9.1, the average 401(k) balance for all individuals, regardless of age, is \$60,000, and individuals closer to retirement have balances around \$90,000. For most people, this is significantly less than necessary for a self-sufficient retirement. This is particularly true for lower-income participants.

**Average and Median 401(k) Balances**



Source: EBRI Issue Brief No. 366, December 2011. Tabulations from EBRI / ICI Participant-Directed Retirement Plan Data Collection Project. Data as of December 31, 2010.

An additional consideration is that TRS member participation in the defined benefit plan is mandatory and the covered employee is required to contribute each month towards the cost of the benefit. Withdrawal of contributions is controlled to discourage use of retirement funds for other purposes. Defined contribution plans, by contrast, tend to experience greater non-participation and leakage of funds through withdrawals and plans loans.

TRS is not asserting that if the State were to change the TRS plan structure TRS members would, by default, be unprepared for retirement. In fact, TRS recognizes that the State could reduce the risk of inadequate savings by making participation in such plans mandatory. However, there is little that the State as plan sponsor could do to protect defined contribution plan participants from extreme market volatility or the factors that lead to generally lower returns when individuals direct their own retirement account investments. Given the current economic climate and the historic underperformance of self-directed defined contribution plans, the risks of under saving in plans with a substantial defined contribution element should be carefully considered.

## Human Capital Management

Finally, a policy issue worth considering is the impact of pension plan design on employee recruitment and retention. Attracting and retaining quality public and higher education employees has long been an issue of importance to Texas lawmakers, and the ultimate goals of any retirement plan are to attract and retain qualified employees and facilitate consistent and predictable retirement patterns. This includes factors such as the following:

- Hiring and retaining qualified employees lowers employer search and training costs.
- High-quality education makes our children, and therefore the state, more economically competitive.
- Retaining qualified employees improves the quality of service and reduces errors.
- Retirement benefits are an essential part of total compensation.
- Retirement security is an important consideration in accepting long-term employment.
- Predictable retirement benefits allow individuals to plan for and manage towards retirement on their own time frame and allow employers to engage in employee transitional planning.

Some studies assert that defined benefit plans play an important role in recruiting and retaining valuable employees. For example, in 2012 Towers Watson surveyed more than 400 defined benefit plan sponsors to gauge employer motivations in retirement plan design. The study found the following:<sup>13</sup>

- Out of the companies surveyed that offer a defined benefit plan, 42.1% continue to do so because they view it as beneficial for retention of valuable employees.
- Among workers under age 40 with a defined benefit plan, nearly three-fourths (72%) cite their retirement plan as a strong incentive to remain with their employer – almost double the percentage (37%) in 2009.
- Between 2009 and 2011, the percentage of workers younger than 40 who agreed their retirement program was an important factor in accepting their job jumped from 28% to 63%.
- Among defined benefit plan participants, 51% say the company's retirement program played a strong role in their decision to join the company in 2011, compared to 31% in 2009.

Yet, other studies offer that mobility, including mobility of retirement benefits for teachers in the form of a defined contribution plan, positively influences recruitment and retention. A study by the State Higher Education Executive Officers (SHEEO) asserts that recruitment and retention of accomplished teachers involves facilitating their mobility across districts and states, which includes personnel policies that give teachers freedom of movement enjoyed by other high-status professions.<sup>14</sup> In light of the SHEEO study, it is useful to note that TRS members have portability within the state and across school district lines. Additionally, TRS has reciprocity with the Employees Retirement System of Texas and proportionate retirement with some other Texas public pension systems.

One fact to note, however, is that if a plan structure encourages workers to stay past their normal-age retirement, then there can be difficulty transitioning the workforce. For example, for the 12 months following the 2008 financial crisis, the number of private sector employees who retired from defined contribution plans decreased dramatically as the individuals lost significant amounts of wealth very quickly. This caused transition issues inside the specific companies and has added to the employment problems facing young individuals in the general workforce. Therefore, TRS concludes that while there are divergent viewpoints as to which pension plan structure attracts and retains the most qualified workforce, a structure that offers more predictability and less annual volatility in wealth created leads to greater predictability in retirement patterns.

## X. Legal Considerations

This Study does not present a detailed analysis of the legal questions that could arise from consideration of various types of changes since it is not known what changes, if any, the Legislature may decide to pursue. However, this section briefly addresses the major legal considerations that could arise, depending on the nature of the changes.

First, the Texas Constitution, Article XVI, Section 67 establishes basic operational and funding requirements for the TRS retirement plan, such as basing the benefits on sound actuarial principles and requiring the Board to invest the funds in accordance with its fiduciary duty. TRS recognizes that if the State adopted a plan with both defined benefit and defined contribution elements, then some portion of the benefit plan would clearly meet the aforementioned constitutional provisions. TRS does not reach a legal conclusion as to whether a stand-alone defined contribution plan or a plan with combined elements would run afoul of the constitutional provisions. Rather, TRS simply highlights that the constitutional provisions merit consideration when contemplating structural plan changes.

Additionally, the Texas Constitution sets the funding requirements for the current plan, including a maximum State contribution rate equal to 10% of payroll. It defines payroll as the “aggregate compensation paid to individuals participating in the system.” If the plan is closed as discussed in Study Section VII, can compensation to new members in a defined contribution plan be considered part of the payroll base upon which the State makes TRS contributions? Additionally, the Texas Constitution allows for the State to exceed the 10% maximum in the case of an emergency, but what qualifies as an emergency under the constitutional language? The answers have material implications on whether it is mathematically possible for the State to close the current plan by moving new hires into a defined contribution plan and still amortize the UAAL without exceeding the Constitutional provisions.

Another legal consideration could arise in assessing the extent to which State contributions based on the compensation of participants in an alternative plan could be applied to the unfunded liability of the closed plan. Under Section 67(b)(3), the State is required to contribute not less than 6% nor more than 10% of the aggregate compensation paid to individuals participating in the system. It is not clear how this provision would be interpreted with regard to the allocation of the required State contribution between two distinctly different plan structures administered by TRS.

With regard to the Texas Constitution, lawmakers would want to consider the extent to which it may protect the current benefits structure for existing participants. Many other states have very strong constitutional protections of benefits accrued by existing employees. In Texas, it is generally assumed that the protections are weaker, but that assumption rests primarily on Texas court opinions rendered before the 1975 adoption of the current constitutional provisions. There has been no judicial interpretation of the provision of Section 67(a)(4), providing that general laws in effect at the time of adoption of the section “remain in effect, subject to the general powers of the legislature established in this subsection.”

Finally, this Study discusses various plan structures in a general manner, without detailed discussion of the tax code requirements of any particular plan type. However, should a legislative proposal emerge from this process, it would be important to structure any alternative plan in accordance with an appropriate plan type available under the federal tax code in order to provide participants with a tax efficient way to participate in a retirement plan.

In conclusion, TRS does not attempt to definitively analyze the legal concerns that may need to be addressed if the State moves to an alternative plan. Any proposal that may emerge will need to navigate state and federal laws that are complex and subject to different interpretations.

## **XI. Conclusion**

While the TRS plan is better funded than the average pension plan with a lower benefit structure and lower contribution rates, the plan has long-term funding challenges that must eventually be addressed. In conducting this Study, TRS’ goal has been to respond to the legislative charge by modeling and analyzing plan options and impacts as directed. TRS stands ready to help educate and inform as lawmakers and stakeholders discuss and address the very important issue of retirement benefits for Texas educators.

## Appendix A – Eligibility Changes Grandfathered

### Eligibility Changes of Figure 3.3 with Grandfather Provisions

| Provision   | Current Provisions | Retirement Eligibility Scenarios for Current Members |         |                        |          |
|---|--------------------|--|---------|------------------------|----------|
| Current Provision   |                    | Rule of 80   |         |                        |          |
| Illustrated Provision   |                    | Rule of 80, Min Age 60                               |         | Rule of 80, Min Age 62 |          |
| Grandfather Members within 5 years of retirement?                   |                    | No   | Yes     | No                     | Yes      |
| Cost of a New Hire  | 10.60%             | 10.60%   | 10.60%  | 10.39%                 | 10.39%   |
| UAAL  | \$24.0B            | \$17.2B  | \$18.9B | \$14.7B                | \$17.3B  |
| Based on Smoothed Value of Assets                                   |                    |  |         |                        |          |
| 30 Year Employer Contribution Rate                                  | 8.13%              | 7.00%  | 7.28%   | 6.39%                  | 6.81%    |
| Funding Period based on 6.40% Member and Employer Contribution Rate | Never              | 59 Years   | Never   | 30 Years               | 43 Years |
| Based on Market Value of Assets                                     |                    |  |         |                        |          |
| 30 Year Employer Contribution Rate                                  | 9.40%              | 8.28%  | 8.56%   | 7.67%                  | 8.08%    |
| Funding Period based on 6.40% Member and Employer Contribution Rate | Never              | Never  | Never   | Never                  | Never    |



## Appendix B – Other System Examples of Alternative Plans

### Defined Benefit-Defined Contribution Hybrid Plans

#### Georgia’s Employee Retirement System

General state employees covered under Georgia’s Employee Retirement System hired after January 1, 2009 are covered under the new hybrid plan while existing members had the option to join the new plan. New hires are automatically enrolled in a defined contribution plan (unless they elect not to participate) and contribute 1% of pay, with additional contributions up to 5%, all of which are eligible for an employer match. The match is 100% of the first 1.0% of pay contribution and 50% of optional contributions, for a maximum match of 3% of pay.

The defined benefit plan will pay 1% of the members’ final 24-month average salary for each year of service. Members contribute 1.25% of pay to the defined benefit plan and the state contributes an actuarially-determined rate.

The system indicated that the change was driven primarily by the preference of young workers, who constituted over 60% of the state’s workforce, for wages over benefits. In response, the state raised wages and introduced a lower cost hybrid plan, with a defined contribution component so that young mobile workers would have a more portable benefit in the event they left state employment.

Members hired after January 1, 2009 have an employer normal cost of 2.98% for the defined benefit portion of the program. Contributions for current unfunded liabilities are in addition to this total, currently about 12.2% of payroll. The members of this program also participate in Social Security, for a total employer contribution of up to 24.38%.

#### Michigan Public School Employees

Public school employees hired after July 1, 2010 automatically contribute 2% of pay to the defined contribution plan (unless they elect not to participate), with additional contributions permitted. The sponsor matches 50% of the member’s first 2% of contributions.

The defined benefit plan for new hires pays 1.5% of the member’s final 60-month average salary for each year of service. Members contribute 6.4% of pay to the plan. The accrual rate is the same as it is under the two predecessor defined benefit plans for school employees, but the age and service requirements for this new defined benefit plan have been increased and the cost-of-living adjustments eliminated.

Based on press reports, the future employer costs (including required contributions for retiree health insurance) were a major motivation for the transition to a hybrid plan. Essentially, the new hybrid plan reduces the benefits compared to the existing defined benefit plan, and the defined contribution plan incorporates a very modest contribution from the employer.

Members hired after July 1, 2010 have an employer normal cost of 2.67% for the defined benefit portion of the program. Contributions for current unfunded liabilities are in addition to this total, currently about 17.03% of payroll. The members of this program also participate in Social Security, for a total employer contribution equal to 26.9%.<sup>15</sup>

## **Utah Retirement System**

In 2010, the Utah Retirement System established their Tier II hybrid plan as a result of the state's goals to reduce the state's and employer's exposure to the financial risk that the current program provides. New hires have the choice between a defined contribution plan and a hybrid plan, but most importantly, the modification created a capped, defined contribution-type, liability for the employer.

If a new member elects to participate in the defined contribution-only plan, the member will receive a 10% of pay contribution from the state. If a new member elects to participate in the hybrid plan, the state will allocate a total of 10% of pay toward the member's retirement benefit. The allocated contribution first goes to pay the ARC of the defined benefit plan as determined by the actuary. Then, after the ARC is paid, anything remaining from the 10% goes to the defined contribution plan. If the defined benefit plan ARC rises, the first consequence is that defined contributions fall. Further, if the defined benefit ARC goes above the state's capped 10% of pay contribution, the defined contributions go to zero and the members must contribute any shortfall.

Stakeholders (state, employers, and employee groups) were able to provide input during the design process. The new design achieved Utah's goal of eliminating the employer's funding risk associated with the delivery of benefits to members in the Tier II benefit program, regardless of the employee's choice for a retirement program.

Contributions for current unfunded liabilities are in addition to this total, currently about 8.3% of payroll. The members of this program also participate in Social Security, for a total employer contribution of 24.5%.

## **Cash Balance Plan**

### **Texas Municipal Retirement System**

Texas Municipal Retirement System (TMRS) is one of the nation's oldest cash balance pension plans. A member's basic benefit is calculated based on an accumulated account balance, but investments are not member-directed like defined contribution plans. Plan features include a 5% interest credit floor, prior service credits, updated service credit, cost-of-living adjustment options, and a lifetime annuity payable upon retirement.

With a menu of benefit options, the contribution requirements vary widely from employer to employer. In addition, most of the individual plans include public safety personnel. For comparison purposes, the median employer contribution rate is 13.22%. In addition, most members of this program also participate in Social Security, for a total median employer contribution (pension plus Social Security) of 19.4%.



## **Nebraska Public Employees Retirement System**

Prior to 2003, all employees were enrolled in a defined contribution plan. In response to concerns that employees were not accumulating enough for retirement in their defined contribution plan, the Legislature established a hybrid cash balance plan for new state and county employees. Existing defined contribution plan participants were given the option to switch to the new hybrid plan.

Members contribute 4.8% of salary pre-tax and the state matches contributions at a 156% match of member contributions. Also, member accounts receive an “interest credit rate” based on the federal mid-term rate plus 1.5% and are guaranteed a minimum annual rate of return of 5%. Members may choose to retire as early as age 55 and the plan provides for multiple payment options of their account at retirement.

The members of this program also participate in Social Security, for a total employer contribution of 21.1%.

## Appendix C – Assumptions for Alternative Plans

### Desired Outcome

A number of assumptions were necessary to perform the requisite modeling. However, one key issue for which TRS was unable to make an assumption was the State's desired outcome in plan design. TRS does not know if the State desires the plan to continue providing the same level of benefits regardless of the cost or if the State aims to keep contribution rates the same and let the benefits vary. Therefore, TRS modeled the alternative plans using two different approaches: (1) The Targeted Benefit Approach assumes that the State wants to keep the ultimate level of expected benefits constant and let the contribution amounts vary; and (2) the Targeted Contribution Approach assumes that the State wants to keep the level of contributions constant and let the ultimate level of benefits vary. Using two different approaches helps ensure the modeling provides an "apples to apples comparison." Often, when alternative plans are examined, items portrayed as cost differences based on plan design are, in fact, differences based on the level of benefits provided. In other words, a model that allows both the benefits and the contributions to vary at the same time creates an "apples to oranges" comparison. By using two different approaches, TRS' modeling holds constant either the level of benefits or the level of contributions and allows for a true comparison of the efficiency of providing benefits under each alternative plan.

### Demographics

The analysis was performed using the profile of new entrants into TRS over the last five years. Members are expected to receive salary increases consistent with the current salary scale assumptions used in the actuarial valuation, which are based on historical trends of TRS members. The same is true for termination assumptions, retirement patterns, and mortality expectations.

## Benefit Provisions

In order to single out the desired metric of either employer contribution or level of benefit, TRS has fixed a set of benefit provisions that will apply across all structures. These are: Rule of 80 retirement eligibility with minimum age 60, a 6.4% member contribution rate, five-year cliff vesting, and no post-retirement benefit increases.

In assuming a 6.4% member rate, TRS is not suggesting that members should only contribute 6.4% to the plan and the State should make up the difference. Rather, TRS kept the member rate fixed and allowed the State contribution to increase under the Targeted Benefit Approach because the goal of this approach is consistency with the current level of benefits. Increasing the member contribution under this approach would be inconsistent with that goal because requiring members to contribute more to receive the same replacement ratio would amount to a benefit reduction. However, as seen in Figure 6.1 below, several of the structures require a higher overall contribution rate to reach the targeted level of benefits, and TRS notes that the State could structure any of these plans to increase the member contribution, thus requiring the members to share in the additional cost. Given that TRS performed the analysis based on the total contributions required, the ultimate findings of the analysis (i.e. the total plan cost to keep the current level of benefits) would not be considerably different if the member rate was increased or decreased across all structures (i.e. the member rate increased to 8% and the State contribution decreased accordingly).

The five-year cliff vesting mimics the current provisions. Varying this provision can have a pronounced impact on the results, especially for defined contribution structures.

## Investment Return

It has been assumed that the TRS trust fund would generate 8% annual investment returns, net of expenses. Self-directed defined contribution accounts would earn 2.7% less than the TRS trust fund, or 5.3% during the member's accumulation period. Additionally, TRS assumed that pooled defined contribution accounts would earn 0.2% less than the current TRS trust fund, or 7.8% per year due to cash flow reductions from the lump-sum distribution feature of this plan.

## Annuitization

To model the replacement ratios across all plans, TRS assumed that all defined contribution accounts would annuitize the balance with an insurance company at retirement. To estimate the cost of an annuity over time, TRS used a 5% discount rate with a 10% load on mortality for margin, administration, commission, and profit. Even though a member could not currently annuitize at a 5% discount rate (current rates are lower and would cost the member more), this analysis is directed at what an average participant would receive at a random point in time.

## Appendix D – Alternative Plan Models Sensitivity to Investment Experience

Actuarial assumptions supply the inputs for a starting point in expectations for projecting future contributions and benefits. Over time, the actual experience will drive the true cost (or benefit). For example, in a defined contribution plan, we have assumed members would generate approximately 5.3% returns per year. However, the actual benefits available to members will be based on what returns the members actually achieve. If the returns are materially less than 5.3%, then the actual benefits will be less. Likewise, if the returns are greater than 5.3%, benefits will be substantially more.

In the defined benefit plan, the over- or under-performance compared to the assumptions will drive the cost requirements over time. Several of the alternative structures share the risk/rewards generated from experience. The following exhibit provides an estimate of how the cost and benefit will change based on the investment returns being 1% higher or lower than the expectation.

| Sensitivity to Investment Experience    |               |     |     |                             |       |       |  |         |  |
|---|---------------|-----|-----|-----------------------------|-------|-------|--|---------|--|
| Structure                               | Relative Cost |     |     | Replacement Ratio at Age 62 |       |       | Percent Change from 1% Decrease in Investment Return |         | Comments   |
|   | -1%           | 8%  | +1% | -1%                         | 8%    | +1%   | Cost   | Benefit |  |
| Current Defined Benefit Plan            | 84            | 100 | 123 | 67.8%                       | 67.8% | 67.8% | 23.0%  | 0%      | Adverse experience absorbed by contribution increases  |
| Side by Side Hybrid                     | 135           | 149 | 163 | 72.1%                       | 68.2% | 65.0% | 11.0%  | -5.0%   | Adverse experience “shared” by cost and benefit  |
| Capped Hybrid                           | 149           | 149 | 149 | 75.9%                       | 68.2% | 61.3% | 0.0%   | -10.0%  | All adverse experience absorbed by benefit   |
| Cash Balance                            | 103           | 112 | 122 | 79.7%                       | 67.5% | 57.4% | 9.0%   | -15.0%  | Adverse experience “shared” by cost and benefit. The first years of experience are absorbed by the active member’s account balance. After retirement, the adverse experience is absorbed by contributions. |
| Pooled Defined Contribution Plan        | 163           | 163 | 163 | 80.0%                       | 67.8% | 57.8% | 0.0%   | -15.0%  | All adverse experience absorbed by benefit   |
| Self-Directed Defined Contribution Plan | 238           | 238 | 238 | 78.4%                       | 67.6% | 58.3% | 0.0%   | -14.0%  | All adverse experience absorbed by benefit   |

Source: Gabriel, Roeder, Smith & Company

## Appendix E - Methodologies and Assumptions: Projected Investment Returns

In order to objectively compare the alternative retirement plans outlined in the TRS Study, specific assumptions about potential investment returns must be made. This Appendix explains those assumptions and the methodologies employed to calculate the returns of the different plan alternatives and is structured into the following two sections:

- Defined Benefit Analysis, which discusses the expected investment returns for the current defined benefit plan; the expected returns for an alternative plan (with a defined benefit component) for new TRS members; and the expected returns of the current defined benefit plan if new TRS members are placed into an alternative plan.
- Self-Directed Defined Contribution Analysis, which describes the expected investment returns for TRS members in either the self-directed defined contribution portion of a hybrid plan or the self-directed defined contribution plan.

First, it is useful to note the following regarding investment forecasting:

- It is virtually impossible to project with any real certainty what will happen over a single year.
- It is reasonably possible to estimate what will happen over a five to 10 year period, based on current market valuations, which will ultimately be transitory.
- It is much more certain to forecast what will happen over a 20-30 year period, regardless of the near-term market environment, assuming that normal desired market conditions will prove to have been most common, despite shorter-term volatility.
- Over longer periods it is reasonable to assume that various cycles will occur and that inflation and interest rates will vary.

As mentioned in the Study, TRS has, on average, 27 years to invest until the average benefit payment comes due. As such, TRS can invest for the “long-term;” therefore, TRS designs its long-term policy allocation using long-term expectations and that particular time frame.

Shorter term forecasts discussed in the media can be volatile and distracting from a long term investment program. While TRS invests for longer-term returns, it is educational to illustrate how a shorter-term focus, that is generally not applicable for a long-lived pension plan, can change expected returns. TRS also provides an intermediate-term (five to seven years) forecast (with generally lower expected returns) to estimate the fund’s return over a shorter period given the current economic environment, the slow pace of growth, and very low interest rates.

Specifically, for the Study, TRS used the following forecasts:

- TRS defines “long-term” as at least as long as the average amount of time TRS has to invest contributions until a benefit payment becomes due (27 years). To approximate these long-term returns, TRS primarily uses JP Morgan’s 15-year horizon market assumptions,<sup>16</sup> which is the longest independently available that we are aware of. The expected return using those long-term assumptions for the current TRS asset allocation is 8%.
- TRS defines “intermediate-term,” as less than 10 years and uses Grantham, Mayo, Van Otterloo (GMO) projections for a seven-year horizon.<sup>17</sup> The expected return using those intermediate-term assumptions for the current TRS asset allocation is approximately 4%.

JPM uses a “building block” approach to arrive at their long-term asset-class return forecasts. The major views underlying their assumptions are as follows:

- Fixed income returns are built by forecasting expected future yields to determine the necessary change in bond prices
- Equity returns are based on inflation expectations plus forecast real earnings growth and dividend yield adjusting for the impact of valuation changes
- Volatility and correlations
  - The historical window for all calculations is 10 years of monthly data.
  - In JPM’s view, investors should adjust for the effects of serial correlation of asset returns on volatility/risk estimates. These effects may lead to a significant underestimation of risk at the asset class, strategy and/or portfolio levels, which may result in excessive risk taking and suboptimal asset allocation decisions.
  - JPM tests for serial correlation and adjusts volatility estimates accordingly, based on quantitative techniques in addition to a qualitative review for reasonableness and consistency.
- High unemployment and deleveraging of the public and private sectors keep inflation low overall while aggressive reflationary central bank policy and rising import prices risk higher inflation over the medium to longer term.
- Strong growth in the emerging economies should drive commodity prices higher, causing headline inflation to outstrip core.

GMO bases their intermediate-term forecasts on the following principles:

- There exists a normal profit margin that balances the supply of, and demand for, capital to any area. If it is too high, competition will enter and margins will regress. If it is too low, competition will exit and increase them.
- There is a normal price-to-earnings multiple that reflects the long-term “true” valuation of stocks held in a market within an economy that is not in secular deflation or inflation. Over time markets will revert back to long-term normal.
- Dividends and sales should also grow at some normal rate. Over time these growth rates will tend to revert back to long-term averages.
- For bonds, return assumptions start with the yield to maturity and inflation assumptions relative to a normalized real yield. If it is too high or low, they assume a return to normal levels.
- Deviations from long-term averages occur but are assumed to correct over seven years. Correction can actually happen much faster (or slower) and often does, usually faster during periods of overvaluation and slower during periods of undervaluation.
- In the absence of a properly functioning economy, (e.g., in a secular deflationary or inflationary environment), it is uncertain how markets will act, especially in the short-term, but eventually historic relationships should return.
- There should be a reasonable equity risk premium because equities are volatile over the short-term and especially during recessions, wars, and financial crises when investors feel the most vulnerable.
- Markets are deemed to be only semi-efficient and can exhibit wide divergences from “intrinsic value” based on problematic or unusual short term conditions.
- Currency differences are not considered a long-term issue, as they generally wash out over longer periods.

## Defined Benefit Component Analysis

### Time Horizon

The analysis began with an examination of the duration of the expected liabilities. The duration of a financial asset or liability consisting of fixed cash flows is the weighted average of the time until those fixed cash flows are received; the longer the duration, the longer the investment horizon that can be employed. The cash flows for the liabilities in this study were provided by TRS' actuary, Gabriel, Roeder, Smith & Company (GRS), for each alternative plan. For the current defined benefit plan or any defined benefit portion of the alternative hybrid plans, the duration of the liabilities is sufficiently long (23 years or more) to maintain the long-term investment strategy currently employed by TRS. Calculating the expected return of the plan requires an asset allocation and a complete set of return (and covariance) forecasts for each asset in the allocation. As discussed above, JP Morgan was selected as the primary source for volatility assumptions and "long-term" asset class forecasts while GMO was selected as the primary source for the "intermediate-term" forecasts.

Three additional assumptions were made:

- The current TRS Investment Policy is the long-term asset allocation;
- Internal return forecasts were used for private equity and real assets; and<sup>18</sup>
- For the "intermediate-term" modeling, GMO does not provide forecasts for all of the liquid asset classes in the current TRS policy allocation. In those cases, TRS disclosed the intermediate return forecasts used.



The following table, Figure E.1, displays the asset allocation, forecasts, and resulting gross return estimates used for the defined benefit plan and the defined benefit portion of hybrid plans:

| <b>Current Policy Allocations and Forecasts Used For Most DB Returns In Study</b> |  |                             |                   |                             |                   |
|---|--|-----------------------------|-------------------|-----------------------------|-------------------|
|   | <b>Current TRS<br/>Policy Allocation</b> | <b>Long-Term</b>            |                   | <b>Intermediate Term</b>    |                   |
|   |  | <b>Forecast<sup>1</sup></b> | <b>Volatility</b> | <b>Forecast<sup>2</sup></b> | <b>Volatility</b> |
| Large Cap Value   | 9.00 %                                   | 9.66 %                      | 20.75 %           | 2.70 %                      | 20.75 %           |
| Large Cap Growth  | 9.00                                     | 10.11                       | 20.50             | 4.10                        | 20.50             |
| Small Cap   | 2.00                                     | 11.21                       | 25.00             | 1.70                        | 25.00             |
| EAFE Unhedged   | 15.00                                    | 10.42                       | 24.75             | 8.30                        | 24.75             |
| Emerging Markets  | 10.00                                    | 13.88                       | 30.50             | 8.90                        | 30.50             |
| Directional Hedge Funds <sup>3</sup>  | 5.00                                     | 8.14                        | 5.90 <sup>6</sup> | 4.30 <sup>5</sup>           | 5.90 <sup>6</sup> |
| Private Equity <sup>4</sup>   | 12.00                                    | 14.00                       | 17.20             | 7.90 <sup>5</sup>           | 17.20             |
| Stable Value Hedge Funds <sup>3</sup>   | 4.00                                     | 6.67                        | 4.01 <sup>6</sup> | 3.30 <sup>5</sup>           | 4.01 <sup>6</sup> |
| Long Treasuries/US Bonds  | 13.00                                    | 2.66                        | 13.75             | 0.70                        | 13.75             |
| Cash  | 1.00                                     | 2.00                        | 0.50              | 2.30                        | 0.50              |
| US Aggregate  | 0.00                                     | 3.07                        | 3.75              | 2.02 <sup>5</sup>           | 3.75              |
| US TIPS/Index Linked Bonds  | 5.00                                     | 3.74                        | 7.00              | 0.10                        | 7.00              |
| REITS   | 0.00                                     | 9.90                        | 25.75             | 0.60                        | 25.75             |
| Commodities   | 0.00                                     | 8.01                        | 18.25             | 6.00 <sup>5</sup>           | 18.25             |
| Real Assets <sup>4</sup>  | <u>15.00</u>                             | 8.00                        | 10.40             | 6.00 <sup>5</sup>           | 10.40             |
| Total   | 100.0 %                                  |                             |                   |                             |                   |
| <b>Expected Gross Annualized Return</b>   |  | <b>8.43 %<sup>7</sup></b>   |                   | <b>4.47 %<sup>7</sup></b>   |                   |

Notes:

- 1 Expected Long-term Returns and Volatility estimates are from J.P. Morgan Asset Management (2012) except where noted
- 2 Expected Intermediate-term Returns and Volatility estimates are from GMO (May 2012) except where noted
- 3 Hedge fund forecasts are a blend of sub-strategies.
- 4 Private Equity and Real Assets expected returns are based on internal TRS projections. Private Equity volatility is based on 10 year annualized benchmark volatility (SSPEI) and Real Assets volatility is based on since inception annualized benchmark volatility (NCREIF ODCE).
- 5 GMO does not provide forecasts for Hedge Funds, Real Assets, Commodities and the US Aggregate Bond Index. We assume the following intermediate-term expected returns: Directional Hedge Funds are Cash plus 2%. Private Equity is the average of Large Cap Value and Growth plus 4.5%. Stable Value Hedge funds are Cash plus 1%. US Aggregate is the current yield on the index. Commodities and Real Assets are reduced by 2% from JPM forecasts.
- 6 Directional Hedge Fund volatility estimated from monthly return data for the HFRI FOF Composite Index from February 1990 to April 2012. Stable Value Hedge Fund volatility estimated from monthly return data for the HFRI FOF Conservative Index for the same period
- 7 Return forecast includes an assumption of 0.15% of alpha primarily from private asset classes. Target alpha for the current policy allocation is 1%.

Source: Teacher Retirement System of Texas

Figure E.1

The Expected Annualized Return reflects both the forecast returns of the individual asset classes and the compounding effects of the portfolio’s volatility or variance over time.

In order to calculate the expected variance of the portfolio TRS used volatility and correlation estimates from JP Morgan, or historical volatility where those estimates were not available (Real Assets and Hedge Funds). Finally, this blended correlation matrix was filtered using a standard approximation technique.<sup>19</sup>

| Correlation Assumptions <sup>1</sup>  |                 |                  |           |       |                  |                         |                |                          |                 |       |              |         |       |             |             |
|---------------------------------------|-----------------|------------------|-----------|-------|------------------|-------------------------|----------------|--------------------------|-----------------|-------|--------------|---------|-------|-------------|-------------|
|                                       | Large Cap Value | Large Cap Growth | Small Cap | EAFE  | Emerging Markets | Directional Hedge Funds | Private Equity | Stable Value Hedge Funds | Long Treasuries | Cash  | US Aggregate | US TIPS | REITS | Commodities | Real Assets |
| Large Cap Value                       | 1               | 0.92             | 0.89      | 0.9   | 0.81             | 0.23                    | 0.87           | 0.28                     | -0.25           | -0.01 | -0.02        | 0.06    | 0.72  | 0.38        | 0.21        |
| Large Cap Growth                      | 0.92            | 1                | 0.86      | 0.86  | 0.8              | 0.23                    | 0.86           | 0.28                     | -0.31           | -0.03 | -0.1         | 0.03    | 0.62  | 0.38        | 0.21        |
| Small Cap                             | 0.89            | 0.86             | 1         | 0.81  | 0.77             | 0.21                    | 0.94           | 0.26                     | -0.29           | -0.05 | -0.1         | 0.01    | 0.76  | 0.37        | 0.18        |
| EAFE                                  | 0.9             | 0.86             | 0.81      | 1     | 0.88             | 0.23                    | 0.81           | 0.26                     | -0.21           | 0.01  | 0.06         | 0.12    | 0.63  | 0.5         | 0.19        |
| Emerging Markets                      | 0.81            | 0.8              | 0.77      | 0.88  | 1                | 0.21                    | 0.78           | 0.24                     | -0.23           | 0.03  | 0.02         | 0.14    | 0.56  | 0.54        | 0.14        |
| Directional Hedge Funds <sup>2</sup>  | 0.23            | 0.23             | 0.21      | 0.23  | 0.21             | 1                       | 0.25           | 0.97                     | -0.18           | 0.23  | -0.12        | 0.16    | 0.22  | 0.33        | 0.36        |
| Private Equity                        | 0.87            | 0.86             | 0.94      | 0.81  | 0.78             | 0.25                    | 1              | 0.29                     | -0.3            | -0.08 | -0.11        | 0.04    | 0.7   | 0.37        | 0.2         |
| Stable Value Hedge Funds <sup>2</sup> | 0.28            | 0.28             | 0.26      | 0.26  | 0.24             | 0.97                    | 0.29           | 1                        | -0.16           | 0.25  | -0.12        | 0.17    | 0.28  | 0.39        | 0.42        |
| Long Treasuries                       | -0.25           | -0.31            | -0.29     | -0.21 | -0.23            | -0.18                   | -0.3           | -0.16                    | 1               | -0.04 | 0.8          | 0.54    | -0.12 | -0.18       | -0.03       |
| Cash                                  | -0.01           | -0.03            | -0.05     | 0.01  | 0.03             | 0.23                    | -0.08          | 0.25                     | -0.04           | 1     | -0.06        | -0.08   | -0.05 | 0.03        | 0.47        |
| US Aggregate                          | -0.02           | -0.1             | -0.1      | 0.06  | 0.02             | -0.12                   | -0.11          | -0.12                    | 0.8             | -0.06 | 1            | 0.79    | 0.13  | 0.06        | -0.12       |
| US TIPS                               | 0.06            | 0.03             | 0.01      | 0.12  | 0.14             | 0.16                    | 0.04           | 0.17                     | 0.54            | -0.08 | 0.79         | 1       | 0.21  | 0.34        | 0.06        |
| REITS                                 | 0.72            | 0.62             | 0.76      | 0.63  | 0.56             | 0.22                    | 0.7            | 0.28                     | -0.12           | -0.05 | 0.13         | 0.21    | 1     | 0.32        | 0.23        |
| Commodities                           | 0.38            | 0.38             | 0.37      | 0.5   | 0.54             | 0.33                    | 0.37           | 0.39                     | -0.18           | 0.03  | 0.06         | 0.34    | 0.32  | 1           | 0.28        |
| Real Assets <sup>2</sup>              | 0.21            | 0.21             | 0.18      | 0.19  | 0.14             | 0.36                    | 0.2            | 0.42                     | -0.03           | 0.47  | -0.12        | 0.06    | 0.23  | 0.28        | 1           |

Notes

<sup>1</sup> Correlation values are JP Morgan estimates, except as noted. The correlation matrix above has been adjusted to be positive semi definite, using a standard approximation technique described in Rebonato and Jackel (1999).

<sup>2</sup> For these asset classes, each pairwise correlation was empirically estimated based on 20 years of monthly returns from the TRS benchmark.

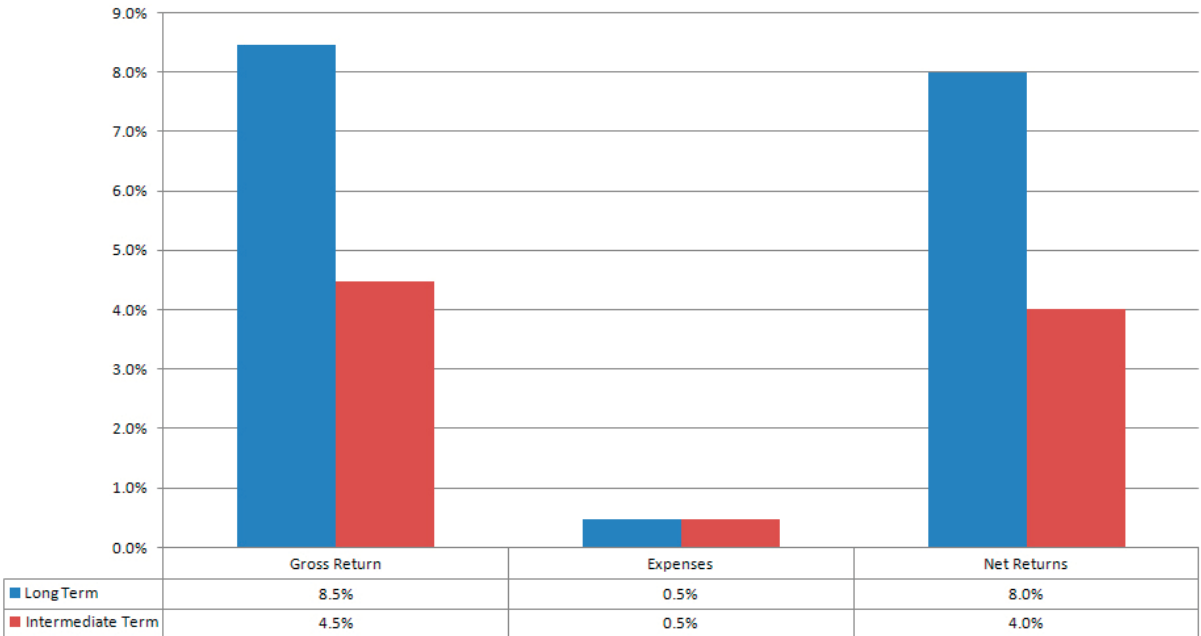
Source: Teacher Retirement System of Texas

Figure E.2

In summary, as shown in Figure E.3, for the current defined benefit plan, a cash balance plan or any defined benefit portion of the alternative hybrid plans the net expected geometric long-term return is expected to be 8% while the intermediate-term net expected return is 4%.

**Projected Investment Returns  
Defined Benefit**

Figure E.3



\*8.5% rounded up from 8.4% for visual purposes

Source: Teacher Retirement System of Texas

### Defined Benefit Returns Assuming a More Liquid Allocation is Needed Due to a Change Toward a Defined Contribution Plan Analysis

TRS determined that if the Legislature decided to place new TRS members in a pooled or self-directed defined contribution plan rather than the current defined benefit, the current defined benefit plan could require a more liquid asset allocation because of increased outflows.<sup>20</sup>

The impact would result in a lower plan return than the current allocation. To adjust the current TRS policy asset allocation for this analysis, TRS would gradually eliminate Private Equity and Real Assets since continuing to invest in those long-lived, illiquid vehicles would no longer be feasible given the anticipated liquidity requirements of the remaining plan. It is important to note that it would likely take between five and 10 years to completely implement the new allocation. The following table, Figure E.4, displays the asset allocation, forecasts, and resulting gross return estimates, after adjusting for a more liquid asset allocation.

Figure E.4

| Policy Allocations and Forecasts Used For DB Remaining Under New DC Plan |                                       |                       |                   |                       |                   |
|--|---------------------------------------|-----------------------|-------------------|-----------------------|-------------------|
|  | Modified<br>Provide More<br>Liquidity | Long-Term             |                   | Intermediate Term     |                   |
|  |                                       | Forecast <sup>1</sup> | Volatility        | Forecast <sup>2</sup> | Volatility        |
| Large Cap Value  | 13.00 %                               | 9.66 %                | 20.75 %           | 2.70 %                | 20.75 %           |
| Large Cap Growth   | 13.00                                 | 10.11                 | 20.50             | 4.10                  | 20.50             |
| Small Cap  | 8.00                                  | 11.21                 | 25.00             | 1.70                  | 25.00             |
| EAFE Unhedged  | 13.00                                 | 10.42                 | 24.75             | 8.30                  | 24.75             |
| Emerging Markets   | 10.00                                 | 13.88                 | 30.50             | 8.90                  | 30.50             |
| Directional Hedge Funds <sup>3</sup>                                     | 3.00                                  | 8.14                  | 5.90 <sup>6</sup> | 4.30 <sup>5</sup>     | 5.90 <sup>6</sup> |
| Private Equity <sup>4</sup>  | 0.00                                  | 14.00                 | 17.20             | 7.90 <sup>5</sup>     | 17.20             |
| Stable Value Hedge Funds <sup>3</sup>                                    | 4.00                                  | 6.67                  | 4.01 <sup>6</sup> | 3.30 <sup>5</sup>     | 4.01 <sup>6</sup> |
| Long Treasuries/US Bonds   | 15.00                                 | 2.66                  | 13.75             | 0.70                  | 13.75             |
| Cash   | 1.00                                  | 2.00                  | 0.50              | 2.30                  | 0.50              |
| US Aggregate   | 5.00                                  | 3.07                  | 3.75              | 2.02 <sup>5</sup>     | 3.75              |
| US TIPS/Index Linked Bonds   | 5.00                                  | 3.74                  | 7.00              | 0.10                  | 7.00              |
| REITS  | 5.00                                  | 9.90                  | 25.75             | 0.60                  | 25.75             |
| Commodities  | 5.00                                  | 8.01                  | 18.25             | 6.00 <sup>5</sup>     | 18.25             |
| Real Assets <sup>4</sup>   | 0.00                                  | 8.00                  | 10.40             | 6.00 <sup>5</sup>     | 10.40             |
| <b>Total</b>   | <b>100.0 %</b>                        |                       |                   |                       |                   |
| <b>Expected Gross Annualized Return</b>                                  |                                       | <b>7.40 %</b>         |                   | <b>2.84 %</b>         |                   |

Notes:

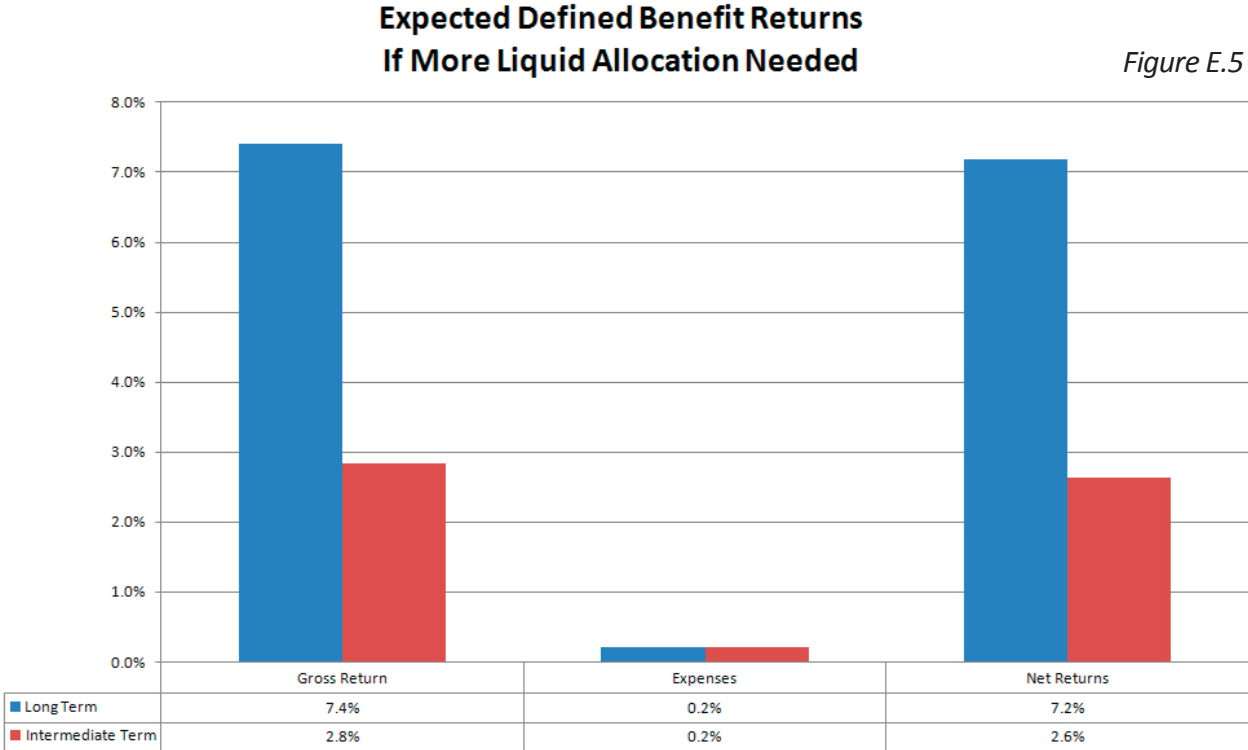
- Expected Long-term Returns and Volatility estimates are from J.P. Morgan Asset Management (2012) except where noted
- Expected Intermediate-term Returns and Volatility estimates are from GMO (May 2012) except where noted
- Hedge fund forecasts are a blend of sub-strategies.
- Private Equity and Real Assets expected returns are based on internal TRS projections. Private Equity volatility is based on 10 year annualized benchmark volatility (SSPEI) and Real Assets volatility is based on since inception annualized benchmark volatility (NCREIF ODCE).
- GMO does not provide forecasts for Hedge Funds, Real Assets, Commodities and the US Aggregate Bond Index. We assume the following intermediate-term expected returns: Directional Hedge Funds are Cash plus 2%. Private Equity is the average of Large Cap Value and Growth plus 4.5%. Stable Value Hedge funds are Cash plus 1%. US Aggregate is the current yield on the index. Commodities and Real Assets are reduced by 2% from JPM forecasts.
- Directional Hedge Fund volatility estimated from monthly return data for the HFRI FOF Composite Index from February 1990 to April 2012. Stable Value Hedge Fund volatility estimated from monthly return data for the HFRI FOF Conservative Index for the same period.

Source: Teacher Retirement System of Texas

### Defined Benefit Fees

Under the current plan, TRS pays 47 basis points annually in aggregate fees and expenses (covering all internal costs and the cost of all external investment managers).<sup>21</sup> For the study, TRS assumed that the cash balance and hybrid plans would continue to pay this amount in fees. However, if the Legislature were to place new TRS members into a self-directed defined contribution plan, and the asset allocations were made as discussed above, the current plan might require a more liquid asset allocation. A more liquid allocation could result in lower expected annual management fees estimated at 21 basis points<sup>22</sup> but would also result in lower expected returns and higher risk from less diversification.

Thus, as shown in Figure E.5, if new TRS members are placed into a self-directed defined contribution plan, the net expected geometric return on the remaining defined benefit plan is expected to be 7.2% and the intermediate-term net expected return is 2.6%.



Source: Teacher Retirement System of Texas

## Self-Directed Defined Contribution Analysis

To generate the expected return for the self-directed defined contribution plan, TRS applied the same intermediate and long-term asset return and covariance estimates used for defined benefit plans. However, TRS also had to choose an appropriate asset allocation that is representative of a defined contribution plan. To create the asset allocation, TRS examined the two largest lifecycle fund families in the world, Fidelity and Vanguard<sup>23</sup>, to examine the asset allocation typically offered to individual investors over various time horizons to retirement.

Defined contribution plans are typically much smaller than the current TRS plan—removing the Federal Thrift Savings Plan, the largest 10 defined contribution employer sponsored plans range from \$17 billion to \$35 billion.<sup>24</sup> The total combined assets of the 14 Fidelity and Vanguard Retirement Funds used for this analysis is only 40% greater than the TRS Trust itself.<sup>25</sup>

TRS used the average asset allocation of Fidelity and Vanguard funds to approximate an individual investor shifting their allocation over time, moving to more fixed income securities as retirement approaches. The following chart, Figure E.6, shows the defined contribution allocations for Fidelity and Vanguard funds.<sup>26</sup> The blue sections highlight asset classes available to the TRS defined benefit plan that are not offered in these plans.

Figure E.6

| Average of Fidelity and Vanguard Lifestyle Funds Used for Defined Contribution Allocations |           |           |           |           |           |           |           |
|--|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
|  | Age 30-34 | Age 35-39 | Age 40-44 | Age 45-49 | Age 50-54 | Age 55-59 | Age 60-62 |
| Large Cap Value  | 25.9 %    | 25.6 %    | 24.8 %    | 22.2 %    | 20.5 %    | 17.9 %    | 15.6 %    |
| Large Cap Growth   | 23.7      | 23.5      | 22.7      | 20.4      | 18.7      | 16.4      | 14.3      |
| Small Cap  | 8.5       | 8.5       | 8.1       | 7.4       | 6.7       | 5.9       | 5.2       |
| EAFE   | 18.6      | 18.3      | 18.3      | 16.0      | 15.0      | 13.0      | 11.2      |
| Emerging Markets   | 5.7       | 5.6       | 5.6       | 4.9       | 4.6       | 4.0       | 3.5       |
| Directional Hedge Funds  | -         | -         | -         | -         | -         | -         | -         |
| Private Equity   | -         | -         | -         | -         | -         | -         | -         |
| Stable Value Hedge Funds   | -         | -         | -         | -         | -         | -         | -         |
| Long Treasuries  | -         | -         | -         | -         | -         | -         | -         |
| Cash   | -         | -         | -         | -         | -         | 1.5       | 2.7       |
| US Aggregate   | 12.6      | 13.7      | 15.5      | 23.9      | 27.8      | 33.9      | 37.5      |
| US TIPS  | -         | -         | -         | 1.0       | 2.6       | 4.1       | 7.1       |
| REITS  | 0.3       | 0.4       | 0.4       | 0.4       | 0.4       | 0.4       | 0.4       |
| Commodities  | 4.7       | 4.5       | 4.5       | 3.7       | 3.6       | 3.0       | 2.6       |
| Real Assets  | -         | -         | -         | -         | -         | -         | -         |
| Total  | 100 %     | 100 %     | 100 %     | 100 %     | 100 %     | 100 %     | 100 %     |

Source: Teacher Retirement System of Texas

Using the averages of the dynamic asset allocation schedules from both Fidelity and Vanguard, TRS calculated the expected return of a typical investor for each of the six, 5-year periods and the one 3-year period during the saving horizon (i.e., working lifetime). Once this was done, an effective, “lifetime” expected gross return for a self-directed defined contribution participant was estimated by calculating a weighted average of all seven different period returns. TRS performed this calculation for both Fidelity (7.07%) and Vanguard (7.39%). For the purposes of this Study, TRS averaged these two numbers to arrive at a final estimate of 7.2%.



### Defined Contribution Fees

To estimate the fees that would be charged to a hypothetical self-directed defined contribution plan participant, TRS used outside sources for market data, considering the amount of assets under management and the number of participants as criteria when selecting inputs. TRS used 0.89% for an estimated annual expense, as displayed below. These fees are almost double the current management fees of the TRS defined benefit plan.

Figure E.7

| Fee Estimate for Self-Directed Defined Contribution Participant |              |  |
|---|--------------|--|
| Type of Fee   | Cost         | Source   |
| Active Investment Management Fees                               | 0.65%        | Investment Company Institute (ICI) <sup>27</sup> |
| Recordkeeping and Admin Fees                                    | 0.15%        | General Accounting Office (GAO) <sup>28</sup>    |
| Oversight Custodial and Other                                   | 0.02%        | TRS Actual Cost <sup>29</sup>                    |
| Consulting and Advisory Fees                                    | 0.07%        | General Accounting Office (GAO) <sup>30</sup>    |
| <b>"All In" Defined Contribution Fee Estimate</b>               | <b>0.89%</b> |  |

Source: Teacher Retirement System of Texas

In addition to management fees, TRS applied a reasonably well documented and conservative estimate of the impact of behavioral biases on individual investors. These demonstrated behavioral tendencies often severely impact individual investor performance and often reflect ineffective risk management, sub-optimal asset allocation, performance chasing, and loss aversion. To quantify the impact of these biases on a self-directed defined contribution plan participant, TRS surveyed the available academic research and assumed a conservative impact estimate of 1%, which is below all the research findings. The range of projected returns in an individual investor format will vary widely.

Figure E.8

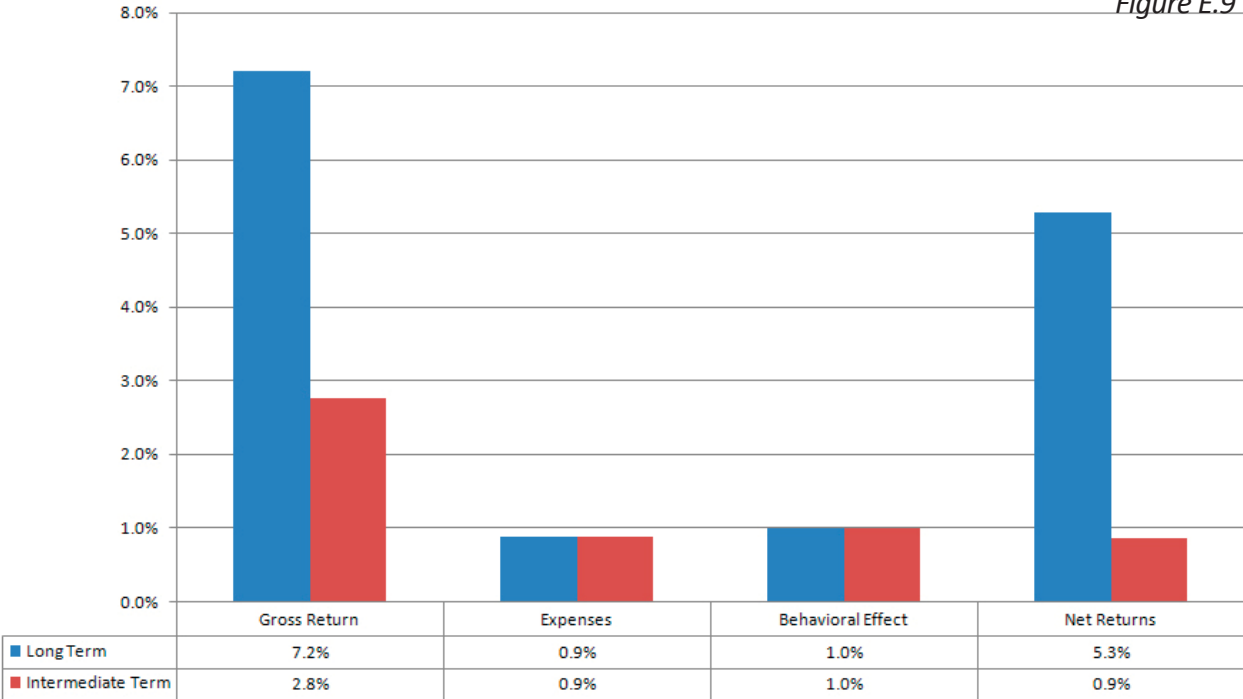
| Estimate of Behavioral Effects for Self-Directed DC Participant |                  |                                |
|---|------------------|--------------------------------|
|   | Observed         |                                |
| Analysis of Underperformance                                    | Underperformance | Source                         |
| Mutual Fund Investors vs. Underlying Funds                      | 1.56%            | Friesen and Sapp <sup>31</sup> |
| Mutual Fund Investors vs. Market Returns                        | 2.69%            | DalBar <sup>32</sup>           |
| Active Brokerage Investors vs. Market Returns                   | 6.50%            | Barber and Odean <sup>33</sup> |
| Average   | 3.58%            |                                |
| <b>Behavioral Effect Selected</b>                               | <b>1.00%</b>     |                                |

Source: Teacher Retirement System of Texas

In summary, for a self-directed defined contribution plan or any defined contribution portion of the alternative hybrid plans the net expected long-term geometric return is expected to be 5.3% and the intermediate-term net expected return is 0.9%.

**Expected Self-Directed DC Returns**

*Figure E.9*



Source: Teacher Retirement System of Texas

**Range of Defined Contribution Outcomes Compared to the Current Defined Benefit Plan**

To illustrate the range of potential retirement outcomes that might occur for an individual with a self-directed defined contribution plan or component, TRS used the defined contribution allocation and the long-term return estimates to simulate 5,000 possible investment experiences for a hypothetical career employee. The process produces estimates of the amount an average employee could accrue by a retirement age of 62.

The inputs included the following assumptions:

- The employee begins working in 2012 at the age of 30 and retires at the age of 62.
- A 6.4% annual contribution rate for the member (the same as the current defined benefit plan).
- A 6.4% annual contribution rate for the state (the same as the current defined benefit plan).
- For salary growth, TRS used assumptions GRS provided for projected member salary over the next 33 years.
- Projected defined contribution fees annually are 0.89% for management and a 1% behavioral effect.
- TRS converted the 5,000 lump sum outcomes accrued by retirement at the age of 62 into a lifetime annuity figure using an annuitization factor provided by GRS.<sup>34</sup>



In order to make relevant comparisons between defined benefit and defined contribution outcomes, TRS calculated a “defined benefit” using the highest five years of salary that the hypothetical employee achieved, consistent with the current TRS benefit formula for new employees.<sup>35</sup>

TRS compared this calculation to the annuity in the self-directed defined contribution and found that for 92% of possible outcomes, the annuity to a current defined benefit retiree exceeds the potential annuity in the defined contribution plan. As illustrated below, modeling showed that two-thirds would receive no more than 60% of the current benefit. Only a handful (about 8%) of the members would receive more than the current defined benefit.

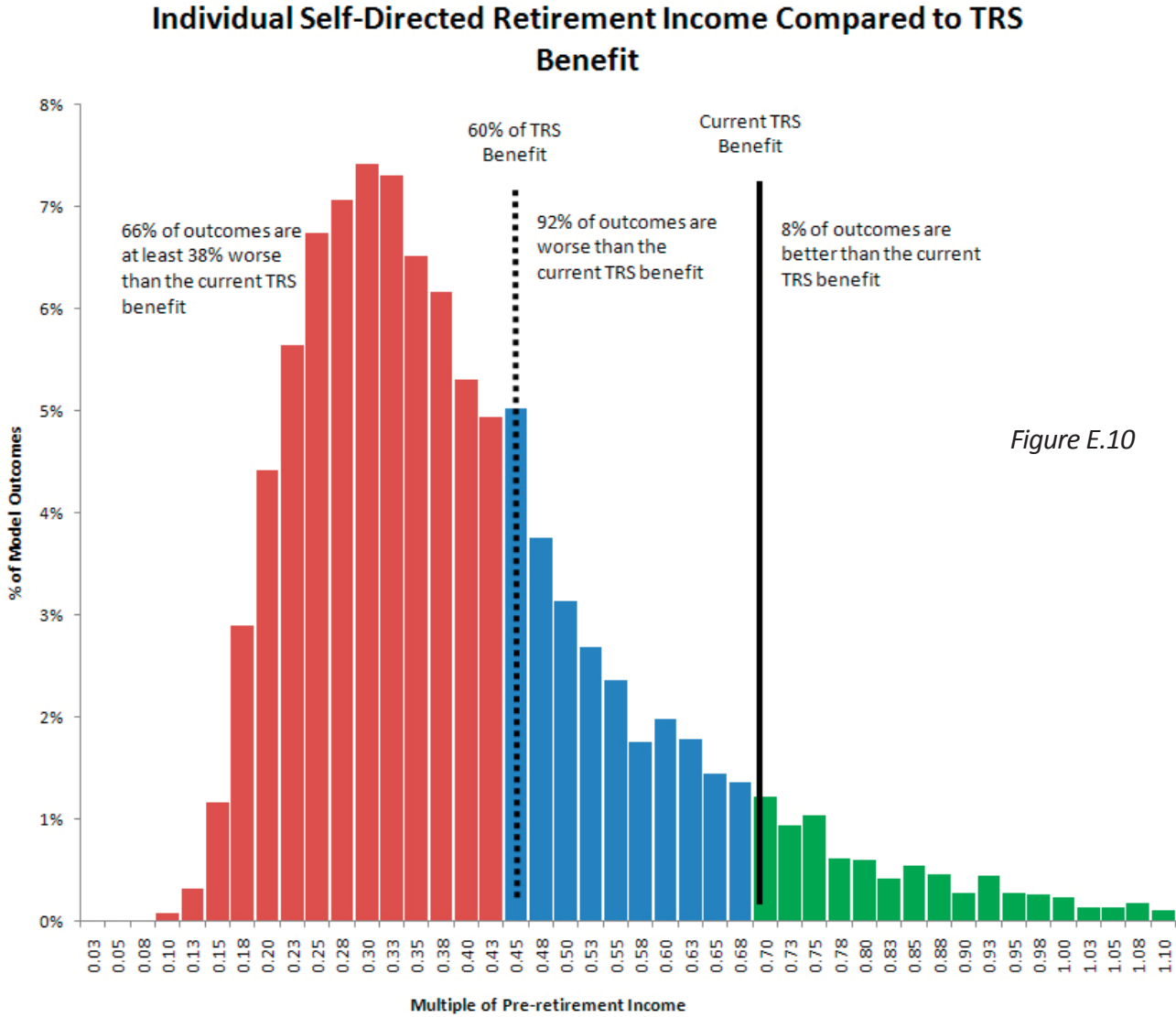


Figure E.10

Source: Teacher Retirement System of Texas

## Additional Information

### Fidelity Portfolio Compositions<sup>36</sup>

| Fidelity Asset Allocations for Freedom Funds as of June 22, 2012 |        |             |             |             |             |             |             |             |
|--|--------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Fund   | Ticker | 2045        | 2040        | 2035        | 2030        | 2025        | 2020        | 2015        |
|  |        | 30-34       | 35-39       | 40-44       | 45-49       | 50-54       | 55-59       | 60-62       |
| Fidelity Series All-Sector Equity Fund                           | FSAEX  | 11%         | 11%         | 11%         | 9%          | 9%          | 8%          | 7%          |
| Fidelity Series Large Cap Value Fund                             | FLVSX  | 10%         | 10%         | 10%         | 9%          | 8%          | 7%          | 6%          |
| Fidelity Growth Company Fund                                     | FDGRX  | 9%          | 8%          | 8%          | 7%          | 7%          | 6%          | 5%          |
| Fidelity Disciplined Equity Fund                                 | FDEQX  | 8%          | 7%          | 7%          | 6%          | 6%          | 5%          | 5%          |
| Fidelity Series 100 Index Fund                                   | FOHIX  | 6%          | 6%          | 6%          | 5%          | 5%          | 4%          | 4%          |
| Fidelity Blue Chip Growth Fund                                   | FBGRX  | 4%          | 4%          | 4%          | 3%          | 3%          | 3%          | 2%          |
| Fidelity Series Small Cap Opportunities Fund                     | FSOPX  | 2%          | 2%          | 2%          | 2%          | 2%          | 1%          | 1%          |
| Fidelity Small Cap Growth Fund                                   | FCPGX  | 1%          | 1%          | 1%          | 1%          | 1%          | 1%          | 1%          |
| Fidelity Small Cap Value Fund                                    | FCPVX  | 1%          | 1%          | 1%          | 1%          | 1%          | 1%          | 1%          |
| Fidelity Series Real Estate Equity Fund                          | FREDX  | 1%          | 1%          | 1%          | 1%          | 1%          | 0%          | 0%          |
| Fidelity Series Commodity Strategy Fund                          | FCSSX  | 9%          | 9%          | 9%          | 7%          | 7%          | 6%          | 5%          |
| Fidelity Series International Growth Fund                        | FIGSX  | 8%          | 8%          | 8%          | 7%          | 6%          | 5%          | 5%          |
| Fidelity Series International Value Fund                         | FINVX  | 8%          | 8%          | 7%          | 6%          | 6%          | 5%          | 5%          |
| Fidelity Series Emerging Markets Fund                            | FEMSX  | 5%          | 5%          | 5%          | 4%          | 4%          | 3%          | 3%          |
| Fidelity Series International Small Cap Fund                     | FSTSX  | 2%          | 2%          | 2%          | 1%          | 1%          | 1%          | 1%          |
| Fidelity Series Investment Grade Bond Fund                       | FSIGX  | 5%          | 9%          | 10%         | 18%         | 18%         | 21%         | 23%         |
| Fidelity Series Inflation-Protected Bond Index Fund              | FSIPX  | 0%          | 0%          | 0%          | 2%          | 5%          | 8%          | 10%         |
| Fidelity Series High Income Fund                                 | FSHNX  | 9%          | 7%          | 7%          | 7%          | 7%          | 6%          | 5%          |
| Fidelity Series Floating Rate High Income Fund                   | FFHCX  | 0%          | 0%          | 1%          | 1%          | 1%          | 1%          | 1%          |
| Fidelity Series Emerging Markets Debt Fund                       | FEDCX  | 1%          | 1%          | 1%          | 1%          | 1%          | 1%          | 1%          |
| Fidelity Series Real Estate Income Fund                          | FSREX  | 0%          | 0%          | 0%          | 0%          | 0%          | 1%          | 1%          |
| Fidelity Institutional Money Market                              | FNSXX  | 0%          | 0%          | 0%          | 0%          | 0%          | 3%          | 5%          |
| Fidelity Short-Term Bond Fund                                    | FSHBX  | 0%          | 0%          | 0%          | 0%          | 0%          | 2%          | 4%          |
| NET OTHER ASSETS   |        | 0%          | 0%          | 0%          | 0%          | 0%          | 0%          | 0%          |
| <b>Total</b>   |        | <b>100%</b> | <b>100%</b> | <b>100%</b> | <b>100%</b> | <b>100%</b> | <b>100%</b> | <b>100%</b> |

Figure E.11

### Vanguard Portfolio Compositions<sup>37</sup>

| Vanguard Asset Allocations for Target Retirement Funds as of June 22, 2012 |        |             |             |             |             |             |             |             |
|--|--------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Fund   | Ticker | 2045        | 2040        | 2035        | 2030        | 2025        | 2020        | 2015        |
|  |        | 30-34       | 35-39       | 40-44       | 45-49       | 50-54       | 55-59       | 60-62       |
| Vanguard Total Stock Market Index  | VTSMX  | 64%         | 64%         | 61%         | 56%         | 50%         | 45%         | 39%         |
| Vanguard Total International Stock Index                                   | VGTSX  | 26%         | 26%         | 26%         | 23%         | 21%         | 19%         | 16%         |
| Vanguard Total Bond Market II Index  | VBMFX  | 10%         | 10%         | 13%         | 21%         | 29%         | 36%         | 41%         |
| Vanguard Inflation-Protected Securities                                    | VIPSX  | 0%          | 0%          | 0%          | 0%          | 0%          | 0%          | 4%          |
| <b>Total</b>   |        | <b>100%</b> | <b>100%</b> | <b>100%</b> | <b>100%</b> | <b>100%</b> | <b>100%</b> | <b>100%</b> |

Figure E.12

## End Notes

<sup>1</sup>TRS Returns as of March 31, 2012.

<sup>2</sup>Hewitt EnnisKnupp analysis presented to TRS Board as of March 31, 2012.

<sup>3</sup>The Impact of Tax Reform on Wage Replacement Ratios. Bruce A. Palmer, Ph.D Center for Risk Management and Insurance Research Georgia State University Atlanta, GA Research Report NO. 88-7 March 1988 and 2008 GSU/Aon Retire Project Report. Bruce A. Palmer Ph.D. Center for Risk Management and Insurance Research, Georgia State University Atlanta, GA Research Report NO. 08-1, June 2008.

<sup>4</sup>As of June 30, 2012.

<sup>5</sup>Vanguard and Fidelity offer broad asset diversification and represent a combined \$84 Billion in Assets across all their lifecycle funds as of June 26, 2011.

<sup>6</sup>JPM Guide to the Markets, Q3 2012 Indexes used are as follows: REITS: NAREIT Equity REIT Index, EAFE: MSCI EAFE, Oil: WTI Index, Bonds: Barclays Capital U.S. Aggregate Index, Homes: median sale price of existing single-family homes, Gold: USD/troy oz, Inflation: CPI Average asset allocation investor return is based on an analysis by Dalbar Inc., which utilizes the net of aggregate mutual fund sales, redemptions and exchanges each month as a measure of investor behavior. Returns are annualized (and total return where applicable) and represent the 20-year period ending 12/31/11 to match Dalbar's most recent analysis.

<sup>7</sup>Based on reported AUM in G Fund, F Fund of \$149B of TSP's \$317 billion in aggregate assets as of year-end 2010.

<sup>8</sup>Based on reported AUM in Lifestyle Funds of \$35B as of year-end 2010 in L2050, L2040, L2030, L2020 and L Income.

<sup>9</sup>CEM Benchmarking. (February 2012). Investment Cost Effectiveness Analysis (for the 5 years ending December 31, 2010).

<sup>10</sup>National Association of State Retirement Administrators. Selected Approved Changes to State Public Pensions to Restore or Preserve Plan Sustainability. May 2012. <http://www.nasra.org/resources/SustainabilityChanges.pdf>.

<sup>11</sup>Internal Revenue Code Section 3121(b)(7)(F) and Revenue Procedure 91-40.

<sup>12</sup>EBRI Issue Brief No. 366, December 2011. Tabulations from EBRI/ICI Participant-Directed Retirement Plan Data Collection Project. Data as of December 31, 2010.

<sup>13</sup>Pensions in Transition: Retirement Plan Changes and Employer Motivations. 2012 Report. Towers Watson. <http://www.towerswatson.com/assets/pdf/7078/Towers-Watson-Retirement-Plan-Changes.pdf>.

<sup>14</sup>Enhancing the Teaching Profession: The Importance of Mobility to Recruitment and Retention. State Higher Education Executive Officers. February 2001.

<sup>15</sup>Primary Source: Alicia H. Munnell, Jean-Pierre Aubry, Josh Hurwitz, and Laura Quinby. (April 2011). A Role for Defined Contribution Plans in the Public Sector. State and Local Pension Plans Issue Brief Number 16. Retrieved from [http://crr.bc.edu/images/stories/slp\\_16\\_508.pdf](http://crr.bc.edu/images/stories/slp_16_508.pdf). © 2011, by Trustees of Boston College, Center for Retirement Research.

<sup>16</sup>JP Morgan Asset Management. (October 2011). Long-Term Capital Market Return Assumptions.

<sup>17</sup>GMO. (May 2012). Seven-Year Asset Class Return Forecasts.

<sup>18</sup>TRS Investment Management Division Board Presentation. (June 2012). Review of Investment Performance and Outlook.

<sup>19</sup>McCulloch, B. (March 2004). Expected geometric return and portfolio analysis. *The Actuary*, 30-31.

<sup>20</sup>It is important to note that this determination would require detailed analysis and a decision by the TRS Board of Trustees before changing policy allocations.

<sup>21</sup>CEM Benchmarking. (February 2012). Investment Cost Effectiveness Analysis (for the five years ending December 31, 2010).

<sup>22</sup>To calculate a hypothetical more liquid fee, TRS eliminated Private Equity and Real Assets fees and assumed the resulting fee percentage would apply to the 25% of the Trust that would be reallocated. CEM Investment Cost Effectiveness Analysis (for the five years ending December 31, 2010), February 2012. Reflects cost of TRS Investment Management Division (oversight, trustee and custodial fees, consulting and performance measurement), and overhead allocation.

<sup>23</sup>Defined contribution money managers in balanced/asset allocation reported by Pensions and Investments as of December 31, 2011. Retrieved August 28, 2012 from <http://researchcenter.pionline.com/rankings?dir=plan-sponsors&menu=overview%7Ccontribution>

<sup>24</sup>Defined contribution plan size reported by Pensions and Investments as of September 30, 2011. Retrieved August 28, 2012 from <http://researchcenter.pionline.com/rankings?dir=plan-sponsors&menu=overview%7Ccontribution>

<sup>25</sup>Defined contribution money managers in balanced/asset allocation reported by Pensions and Investments as of December 31, 2011. Retrieved August 28, 2012 from <http://researchcenter.pionline.com/rankings?dir=plan-sponsors&menu=overview%7Ccontribution>

<sup>26</sup>See Additional Information for detail on funds used in analysis.

<sup>27</sup>Average Expense Ratio for Hybrid Mutual Funds, 10th percentile (to account for large projected size of a possible TRS DC plan). Investment Company Institute. (2012). 2012 Investment Company Fact Book 52nd Edition. Investment Company Institute.

<sup>28</sup>Recordkeeping and Administrative Fees for plans with more than 500 Participants. United States Government Accountability Office. (2012). 401(K) Plans: Increased Educational Outreach and Broader Oversight May Help Reduce Plan Fees.

<sup>29</sup>CEM Investment Cost Effectiveness Analysis (for the five years ending December 31, 2010), February 2012.

<sup>30</sup>Median Consulting and Advisory Fees for plans with more than 500 Participants. United States Government Accountability Office. (2012). 401(K) Plans: Increased Educational Outreach and Broader Oversight May Help Reduce Plan Fees.

<sup>31</sup>Friesen, Geoffrey C., and Travis A. Sapp, "Mutual Fund Flows and Investor Returns: An Empirical Examination of Fund Investor Timing Ability," *Journal of Banking and Finance* (September 2007), 2796–2816.

<sup>32</sup>Average mutual fund results based on 10 year performance difference, weighted equally, of the average equity investor and average fixed income investors and the S&P 500 and Barclays Aggregate Bond indexes, respectively. DALBAR, "Quantitative Analysis of Investor Behavior (QAIB), 2012."

<sup>33</sup>Performance of brokerage accounts with the highest monthly turnover compared to market return. Barber, Brad M., and Terrance Odean, "Trading Is Hazardous to Your Wealth: The Common Stock Investment Performance of Individual Investors," *Journal of Finance*, LV (2000), 773–806.

<sup>34</sup>The annuitization factor provided by GRS, the Trust's actuary, is 13.4.

<sup>35</sup>Formula is 2.3% times years of service (33) times average of highest five years of salary. Salary estimates provided by GRS.

<sup>36</sup>Portfolio Composition for each Freedom Fund obtained from Fidelity Investments. (1995-2012). Freedom Funds. Retrieved June 22, 2012, from Fidelity.com: <http://personal.fidelity.com/products/funds/content/DesignYourPortfolio/freedomfunds.shtml.cvsr?refpr=zdypff004>

<sup>37</sup>Portfolio Composition for each Target Retirement Fund obtained from The Vanguard Group. (2008-2012). Vanguard Target Retirement Funds. Retrieved June 22, 2012, from <https://personal.vanguard.com/us/home>: <https://personal.vanguard.com/us/funds/vanguard/TargetRetirementList>