Leslee Hardy, ASA, EA, FCA, MAAA
Director of Actuarial Services, TMRS
Mark Randall, EA, FCA, MAAA
CEO, Gabriel, Roeder, Smith & Co.
T.J. Carlson, MBA, CAIA, CTP
Chief Investment Officer, TMRS
The TMRS Board has made a number of actuarial changes to improve the System’s sustainability:

- Adopted new “Generational” mortality tables (2013)
- Approved a change in the actuarial cost method from “Projected Unit Credit” to “Entry Age Normal” (2013)
- Lowered the actuarial assumed rate of return from 7% to 6.75% (2015)
Funding for All Retirement Plans

Contributions (C) + Income (I) = Benefits (B) + Expenses (E)
• Each TMRS city is independently funded, with its own assets and liabilities.

• The contribution rate for each TMRS city is set annually by an actuarial valuation performed as of December 31 of the preceding year. For example, the 2017 rate was set in May 2016 based on a valuation performed as of December 31, 2015.

• Annual Rate Letters for each city are posted on the TMRS website in June each year. We also send cities an annual rate reminder letter in January each year.
The primary financial objective of TMRS is to pre-fund the long-term costs of promised benefits to plan members and beneficiaries at an approximate level percent of payroll from year to year.

The Actuarial Funding Policy is the “road map” for this objective.
The City’s employer contribution determined annually under this funding policy is called the Actuarially Determined Employer Contribution (ADEC) and serves as the basis for determining the Full Retirement Rate contribution under TMRS.

The TMRS **Actuarial Funding Policy** is posted on the TMRS website:

www.tmrs.com/publications_cities.php
The ADEC, which consists of a normal cost contribution rate and a prior service cost contribution rate, is determined by the following three key components:

1. Actuarial Cost Method
2. Asset Smoothing Method
3. Amortization Policy
Actuarial Cost Method

• Allocates the total present value of future benefits over an employee’s working career
• TMRS uses the Entry Age Normal (EAN) actuarial cost method

Actuarial Smoothing Method

• Recognizes gains or losses in pension assets over some period of time so as to reduce the effects of market volatility and stabilize contributions
• Actuarial Value of Assets (AVA) is based on the Market Value of Assets (MVA) with ten-year smoothing applied
Recent BAF interest credits to cities:

<table>
<thead>
<tr>
<th>Year</th>
<th>Market Return</th>
<th>Actuarial Return*</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>2.37%</td>
<td>7.15%</td>
</tr>
<tr>
<td>2012</td>
<td>9.95%</td>
<td>7.43%</td>
</tr>
<tr>
<td>2013</td>
<td>9.70%</td>
<td>7.66%</td>
</tr>
<tr>
<td>2014</td>
<td>5.68%</td>
<td>7.45%</td>
</tr>
<tr>
<td>2015</td>
<td>0.06%</td>
<td>6.69%</td>
</tr>
</tbody>
</table>

* Assumption was 7%; beginning in 2016, assumption is 6.75%
Amortization Policy

• The length of time and the structure selected for increasing or decreasing contributions to systematically eliminate any Unfunded Actuarial Accrued Liability or surplus

• The TMRS Act allows for open or closed amortization periods up to a maximum of 25 years

• Board rules allow additional flexibility for amortization periods
Ad Hoc COLAs and Updated Service Credit (USC)

• TMRS recommends that cities that intend to grant COLAs or USC on a regular basis adopt these as annually repeating benefits.

• All ad hoc benefits for TMRS cities are funded over a 15-year closed period.

• Cities with a consistent pattern of adopting ad hoc benefits will likely see contribution rates steadily increase (and funded ratios decrease) over time.

• Ad hoc benefits that are regularly adopted will be valued for GASB 68 financial reporting purposes as though they are annually repeating benefits.
An Experience Study is a review of the assumptions and methods used by the actuary

- TMRS has one prepared every four years
- Five-year interval considered reasonable
  - GFOA recommends at least once every five years

This report tries to answer these questions for each assumption

- What was TMRS’ actual experience?
- How does that compare with current assumptions?
- Is a change warranted?
Assumptions are updated to reflect economic conditions, member behavior, retirement/termination/salary patterns, and mortality.

Based on results of the study, the Actuary recommends revised assumptions to the TMRS Board of Trustees, and the Board considers the Actuary’s recommendation and makes the final decision for the System.

The assumption set selected should be reasonable overall.

Keeping assumptions up-to-date will minimize gains and losses and manage volatility of the contribution rates for TMRS cities.
The actual asset allocation of the trust fund will significantly affect the overall performance. This means:

- The Investment Return Assumption cannot be based on a different allocation
- How you are invested drives the long-term expected rate of return
• Actuaries use a “building block” approach
  Long Term annual Investment Return Rate = Inflation Rate + Annual Real Rate of Return
• TMRS’ long-term rate of return assumption was 7.00%
  3.00% Inflation + 4.00% Real Return
• As of 12/31/15, the return assumption is 6.75%
  2.50% inflation + 4.25% Real Return
Inflation

• Inflation is measured by annual increases in the Consumer Price Index (CPI).

• Prior to the experience study, TMRS’ inflation assumption was 3.00% per year; changed to 2.50%.

• Actual inflation (measured by the CPI) during
  • Last 5 years: 1.69%
  • Last 20 years: 2.28%
  • Last 30 years: 2.71%
  • Since 1913:* 3.17%

* First available year
To analyze the expected real return, the Actuary:

- Combines TMRS’ target asset allocation with capital market expectations.
- Examines the most recent capital market return assumptions developed by eight investment consulting firms.
  - Placing emphasis on information from TMRS’ Investment consultant, RVK
  - Mostly 5-10 year time horizons
- Adjusts the results for a difference in time horizon.
  - Duration of the Plan liabilities is over 20 years
## Impact from Material 2015 Experience Study Results

<table>
<thead>
<tr>
<th></th>
<th>Prior Assumption</th>
<th>New Assumption</th>
<th>Impact on Liabilities/Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inflation</td>
<td>3.00%</td>
<td>2.50%</td>
<td></td>
</tr>
<tr>
<td>Nominal Investment Return</td>
<td>7.00%</td>
<td>6.75%</td>
<td>Increase +++</td>
</tr>
<tr>
<td>General Wage Growth</td>
<td>3.00%</td>
<td>3.00%</td>
<td>None</td>
</tr>
<tr>
<td>Long-Service Salary Scale</td>
<td>4.08%</td>
<td>3.50%</td>
<td>Decrease ++</td>
</tr>
<tr>
<td>Post-Retirement Benefit Increases (Shown for 70% of CPI)</td>
<td>2.10%</td>
<td>1.86%</td>
<td>Decrease ++</td>
</tr>
<tr>
<td>Rates of Termination (A/E Ratio)</td>
<td>95%/93%</td>
<td>101%/102%</td>
<td>Increase +</td>
</tr>
<tr>
<td>City Termination Load</td>
<td></td>
<td></td>
<td>As much as +/- 5%</td>
</tr>
<tr>
<td>Percentage taking Refund (A/E Ratio)</td>
<td>92%</td>
<td>101%</td>
<td>Increase +</td>
</tr>
<tr>
<td>Population Decline</td>
<td>NA</td>
<td>50% of recent experience</td>
<td>Increase where applicable</td>
</tr>
</tbody>
</table>

+, ++, +++ indicate the relative degree of impact
# Summary of System-Wide Results

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Actuarial Accrued Liability (AAL)</td>
<td>$26,647</td>
<td>$28,117</td>
<td>$28,379</td>
</tr>
<tr>
<td>Actuarial Value of Assets</td>
<td>$22,861</td>
<td>$24,348</td>
<td>$24,348</td>
</tr>
<tr>
<td>Unfunded Actuarial Accrued Liability (UAAL)</td>
<td>$3,786</td>
<td>$3,769</td>
<td>$4,031</td>
</tr>
<tr>
<td>Funded Ratio</td>
<td>85.8%</td>
<td>86.6%</td>
<td>85.8%</td>
</tr>
<tr>
<td><strong>Full Contribution Rates:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Straight Average</td>
<td>8.39%</td>
<td>8.33%</td>
<td>9.02%</td>
</tr>
<tr>
<td>Payroll Weighted Average</td>
<td>12.63%</td>
<td>12.54%</td>
<td>13.24%</td>
</tr>
<tr>
<td>Normal Cost %</td>
<td>7.86%</td>
<td>7.88%</td>
<td>8.41%</td>
</tr>
<tr>
<td>Prior Service %</td>
<td>4.77%</td>
<td>4.66%</td>
<td>4.83%</td>
</tr>
</tbody>
</table>

Source: GRS, May 2016
Effect of Experience Study

Contribution Outlook for 2017

• Most cities saw less than 1.00% increase in contribution rates resulting from the Experience Study assumption changes.
• Cities with a net contribution increase greater than 0.50% due to these changes are allowed to phase in the increase at 0.50% per year.
• Cities with repeating COLAs generally saw less rate impact than cities with Ad Hoc or no COLAs.

TMRS always recommends that cities pay the ADEC in full, if possible
A Word About GASB 68

• Disclosure numbers under GASB 68 are not the same as actuarial funding numbers.
• GASB 68 effectively separated accounting reporting from funding.
• A sound funding policy is the key to ensuring sustainable and secure retirement benefits over all generations of workers.
• Understanding how funding works will help cities answer questions from officials, the press, and the public about the disclosure numbers.
A Word About GASB 68

• Most cities are now in the second year of reporting under the new GASB 68 requirements.
• The resources cities and their auditors need for GASB compliance are on the TMRS website’s “Eye on GASB” page and the City Portal.
• Questions about GASB reporting should be addressed to pensionaccounting@tmrs.com.
Overview of TMRS Investments

T. J. Carlson, Chief Investment Officer, TMRS
• Performance and Asset Allocation
• Public Equities
• Fixed Income
• Securities Lending
• Real Estate
• Real Return
• Absolute Return
• Private Equity
• Compliance
• Risk Management
Performance and Asset Allocation
TMRS INVESTMENT PORTFOLIO

Asset Allocation

Allocation as of 6/30/2016

- Non-Core Fixed Income: 6.8%
- Cash Equivalents: 0.1%
- Core Fixed Income: 25.2%
- US Equities: 27.1%
- Real Estate: 6.8%
- Real Return: 7.2%
- Non-US Equities: 16.5%
- Private Equity: 0.3%

Target Allocation Adopted July 2015

- Core Fixed Income: 10.0%
- Non-Core Fixed Income: 20.0%
- US Equities: 17.5%
- Non-US Equities: 17.5%
- Private Equity: 5.0%
- Real Estate: 10.0%
- Real Return: 10.0%
- Absolute Return: 10.0%

Total Market Value: $24.3 Billion

*Cash equivalents allocation represents unallocated invested cash equivalent instruments.

NOTE: The sum of individual asset class allocations may not add up to 100% due to rounding.

Source: State Street Investment Analytics – Preliminary performance estimate
TMRS INVESTMENT PORTFOLIO
Gross Performance By Asset Class
June 2016

1 Year Performance

5 Year Performance

Gross returns
*Real Estate return as of prior quarter end (real estate returns are available on a quarterly basis only)
+Absolute Return returns are a mix of gross and net.
^Non-Core Fixed Income, Real Return, Real Estate, Absolute Return performance are the annualized return since inception, given their performance history are less than 5 years
Source: State Street Investment Analytics – Preliminary performance estimate
Public Equities
US Equity

- Objective
  - Intended to provide capital appreciation and is structured using a Core-Satellite Approach with the overall objective of exceeding its benchmark performance net of fees over rolling five year periods.
  - Satellite strategies (Active and Rules-Based strategies with an active component) are expected to add excess return within established tracking error limits and will meet quality, diversification, and liquidity guidelines as specified in the Managers’ contracts.

International Equity

- Objective
  - Intended to provide capital appreciation and diversification, and is structured using a Core-Satellite Approach with the overall objective of exceeding its benchmark performance net of fees over rolling five year periods.
  - Satellite strategies (Active and Rules-Based strategies with an active component) are expected to add excess return within established tracking error limits and will meet quality, diversification, and liquidity guidelines as specified in the Managers’ contracts or otherwise agreed to in writing between TMRS and the Investment Manager.
Public Equities
Manager Diversification
As of June 30, 2016

Based on June State Street preliminary performance.
Note: Percentages may not be exact due to rounding.
Fixed Income
Objective

- Purpose is to diversify the risk of the overall investment portfolio with a secondary goal of capital preservation.
- Performance objective is to exceed the Barclay’s US Aggregate Bond Index net of fees over rolling five-year periods and within tracking errors as specified in the Manager contracts, determined according to the specific strategies employed.

Investment Philosophy- BlackRock

- Top down determination of investment themes are based on bottom-up inputs. Investment themes establish parameters for sector, sub-sector and security selection. Macro overlays for duration and volatility are viewed as a separate sector and used opportunistically.

Investment Philosophy- PIMCO

- PIMCO’s investment philosophy is driven by diversifying strategies and focuses on longer term secular (3-5 year) trends.
- Seek to add value through top down strategies including interest rate exposures, duration, volatility, yield curve positioning and sector rotation.
- Employ “bottom-up” strategies through in depth credit analysis and specific security selection.
Core Fixed Income Allocation
As of June 30, 2016

<table>
<thead>
<tr>
<th>Mandate</th>
<th>Market Value</th>
<th>% of Total Fund</th>
</tr>
</thead>
<tbody>
<tr>
<td>CORE FIXED INCOME</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BlackRock</td>
<td>$4,089,299,168</td>
<td>16.84%</td>
</tr>
<tr>
<td>PIMCO</td>
<td>$2,024,051,340</td>
<td>8.34%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>$6,113,350,508</td>
<td>25.18%</td>
</tr>
</tbody>
</table>

NOTE: Based on preliminary figures.
Objective

- The purpose is to enhance total return through income and capital appreciation and provide diversification to the total investment portfolio. This allocation may be managed actively and/or passively through multiple managers in consideration of manager concentration risk.

- The Performance Objective is to exceed the returns of a blended benchmark comprised of the Barclays US Corporate High Yield Index 50%, the JPM GBI-EM Global Diversified Index (USD Unhedged) 25%, and JPM CEMBI Broad Diversified Index 25%, net of fees over rolling five-year periods and within tracking errors as specified in the manager contracts or otherwise agreed to in writing, determined according to the specific strategies employed.
Non-Core Fixed Income Allocation
As of June 30, 2016

<table>
<thead>
<tr>
<th>Mandate</th>
<th>Market Value</th>
<th>% of Total Fund</th>
</tr>
</thead>
<tbody>
<tr>
<td>NON-CORE FIXED INCOME</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Guggenheim</td>
<td>$386,068,226</td>
<td>1.59%</td>
</tr>
<tr>
<td>Highland</td>
<td>$369,145,844</td>
<td>1.52%</td>
</tr>
<tr>
<td>Voya Investment Management</td>
<td>$383,877,315</td>
<td>1.58%</td>
</tr>
<tr>
<td>Ellington Management Group</td>
<td>$384,743,217</td>
<td>1.58%</td>
</tr>
<tr>
<td>Golub</td>
<td>$38,045,454</td>
<td>0.16%</td>
</tr>
<tr>
<td>White Oak</td>
<td>$79,458,112</td>
<td>0.33%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>$1,641,338,168</td>
<td>6.76%</td>
</tr>
</tbody>
</table>

Non-Core Weighting vs. Target

- **Actual**: 6.8%
- **Target**: 20.0%
- **Difference**: -13.2%

NOTE: Based on preliminary figures.
Objective

- To enhance total return and provide diversification to the overall investment portfolio.
- Due to the illiquid and cyclical nature of the real estate asset class, Staff and the Real Estate Investment Consultant recommend that the target allocation be invested over a multi-year period in order to avoid considerable vintage year risks.

Performance Objective

- Long term performance objective is a real rate of return (adjusted for inflation) of five percent (5%) net of investment management fees.
- The real estate portfolio is expected to generate returns net of all fees and expenses, in excess of their respective indices, over rolling five year investment time horizons.
Real Estate Manager Diversification

Seeking top performing managers to form beneficial partnerships for the TMRS real estate portfolio. The number of partnerships is being watched closely so monitoring and maintenance does not become an undue cost.

Sizing of manager relationships remains critical, based upon portfolio needs, manager capabilities & opportunity set.

Blue-scale: Core Mandates
Purple-scale: Value-Add
Orange-scale: Opportunistic

Real Estate Portfolio Manager Diversification
(by Adj. Commitments)

- Blackstone Property Partners (2016)
- Stockbridge SmartMarkets (2011)
- USAA Eagle Fund (2015)
- Harrison Street Core Fund (2011)
- H/2 Credit Partners (2015)
- Walton Street Debt I (2014)
- H/2 Core Debt (2015)
- Abacus CIF I (2013)
- Stockbridge VA Fund I (2012)
- Greenfield Acquisition Partners VII (2013)
- Rubenstein PF II (2012)
- Greenfield Acquisition Partners VI (2012)
- Miller Global VII (2012)
- Stockbridge VA Fund II (2014)
- Abacus Multi-Family Fund III (2014)
- Rubenstein PF III (2015)
- Torchlight DOF V (2015)
- DivcoWest V (2016)
- Abacus Multi-Family Fund II (2012)
- Alcion Ventures III (2015)
- TPG Realty Fund II (2015)
- Killearn EP II (2016)
- Walton Street Equity VII (2012)
- Lubert-Adler Fund VII (2013)
- Moorfield Real Estate Fund III (2014)
- Tristan EPISO IV (2015)
Real Estate Portfolio Diversification

Property Type Diversification Based on Market Value

Geographic Diversification Based on Market Value

Source: Courtland Q4 2015 Report
Real Return
Objective

- Purpose is to enhance total return and provide diversification and hedge against inflation risks to the overall investment portfolio.
- Due to the varied nature of the Real Return space the portfolio will include strategies across a variety of real asset types as well as a number of investment vehicle types in order to maintain a diversified approach.

Performance Objective

- Long term performance objective over a period of 5 years or a full market cycle is a real rate of return (adjusted for inflation) of CPI + 400 basis points.
- On a short term basis the real return portfolio is expected to generate returns net of all fees and expenses, in excess of their respective indices individually and in excess of the Barclay’s World Government Inflation Linked Bond Index for the portfolio as a whole.
Real Return Allocation
As of June 30, 2016

Real Return Manager Diversification by Commitment

Post-Recommendation Exposure by Manager
## Liquid Real Return Portfolio Management Structure
### June 30, 2016

<table>
<thead>
<tr>
<th>MANAGER</th>
<th>STRATEGY</th>
<th>PORTFOLIO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colchester</td>
<td>Active Global Linkers</td>
<td>Barclays World Govt Infl-Linked Bond Index</td>
</tr>
<tr>
<td>Nuveen</td>
<td>Real Asset Income – Public Securities</td>
<td>28% S&amp;P Global Infrastructure Index, 21% FTSE EPRA/NAREIT Developed Index, 18% Wells Fargo Hybrid and Preferred Securities REIT Index, 15% Barclays Global Capital Securities Index, 18% Barclays U.S. Corporate High Yield Index</td>
</tr>
<tr>
<td>Cohen &amp; Steers</td>
<td>Real Assets Multi-Strategy</td>
<td>27.5% Bloomberg Commodity Index, 27.5% FTSE NAREIT Developed Real Estate Index (Net), 15% Dow Jones Brookfield Global Infrastructure Index, 15% S&amp;P Global Natural Resources Index—Net), 10% BAML US Corporate Index, 1–3 Years and 5% Gold Index</td>
</tr>
<tr>
<td>Manager</td>
<td>Strategy</td>
<td>Allocated/Committed</td>
</tr>
<tr>
<td>-------------</td>
<td>-------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>Magnetar</td>
<td>Energy Finance</td>
<td>$100,000,000</td>
</tr>
<tr>
<td>Orion</td>
<td>Mining Finance</td>
<td>$100,000,000</td>
</tr>
<tr>
<td>Amerra</td>
<td>Agriculture Finance</td>
<td>$100,000,000</td>
</tr>
<tr>
<td>Brookfield</td>
<td>Infrastructure</td>
<td>$150,000,000</td>
</tr>
</tbody>
</table>

Source: TMRS Accounting
Absolute Return
Objective

• Purpose is to diversify equity and credit market risk by targeting hedge fund return streams that are independent of the directionality of the broad stock and bond markets. The ARS portfolio will be invested in a wide variety of hedge fund strategies, with specific constraints on overall portfolio risk and individual manager exposure.

• Performance objective is to exceed the benchmark, defined as the HFRI Fund of Funds Diversified Index, net of fees, and to earn in excess of the appropriate long-term benchmark (3-month LIBOR + 500 basis points) on an ongoing rolling 5-year period.

Investment Philosophy

• Predicated on manager skill in:
  • Rotating (long/short trading) market factors based on valuation
  • Navigating less liquid, non public and opaque markets
  • Navigating special situations
  • Predicting and capturing market trends

• Accordingly, ARS is not an “asset class” (or market sector)
Absolute Return Allocation  
As of June 30, 2016

Absolute Return: Strategy Diversification

Absolute Return: Manager Diversification

Policy Guidelines

No more than 15% with any one investment manager (excluding FoFs)
No more than 10% in any one investment vehicle (excluding FoFs)

NOTE: Percentages may not be exact due to rounding
Private Equity
Objective

- The primary objective is to enhance the total return of the overall investment portfolio, and secondarily to provide diversification. Private Equity investments are commingled funds structured as limited partnerships with capital commitments that are drawn down over time based on manager discretion. Potential distributions are made as a fund matures and investments are typically realized over an 8-12 year horizon.
- The long term policy objective is to meet or exceed the Russell 3000 + 3.00% over periods of five years or greater.

Investment Philosophy

- Manager selection is critical, and managers add value through:
  - Reducing agency conflicts and aligning equity holder/executive incentives
  - Investment structuring and balance sheet management
  - Deep sector experience and creating operating efficiencies
  - Navigating non-public information and capturing illiquidity premia

Note: Due to the illiquid nature of the Private Equity asset class, the target allocation will be invested over a multi-year period in order to avoid considerable vintage year risks.
Private Equity Allocation
As of June 30, 2016

Policy Strategy Range

- Control/Buy-out: 40.0% to 75.0%
- Venture/Growth/Minority: 5.0% to 25.0%
- Special Situations/Opportunistic: 10.0% to 35.0%

NOTE: Percentages may not be exact due to rounding
Private Equity Allocation
As of June 30, 2016

Policy Guidelines
No more than 35% with any one investment manager
No more than 25% in any one investment vehicle

NOTE: Percentages may not be exact due to rounding
Compliance
IPS Objectives

• The primary objective of Compliance is to implement a detailed compliance program which uses a combination of daily, weekly and monthly testing of all testable parameters of the Investment Policy Statement and all Manager guidelines at the Manager, asset class and total fund level, as appropriate.

• Testing may be completed either through systematic resources (automated custodial compliance) or manually if necessary.

• Compliance personnel shall create and present a quarterly report to the Board with the results of the testing performed during each period.
### Investment Guideline Compliance

#### March 2016

<table>
<thead>
<tr>
<th>Policy Guidelines</th>
<th>Core Fixed Income</th>
<th>Non-Core Fixed Income</th>
<th>Real Return</th>
<th>Domestic Equities</th>
<th>Global Equities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Credit Quality</strong></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Liquidity/Cash Management</strong></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Permissible/Prohibited Investments</strong></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Concentration Risk</strong></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Country/Region &amp; Currency</strong></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Issue/Issuer</strong></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Sector &amp; Asset Type</strong></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Interest Rate Risk</strong></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Spread Risk</strong></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

- 366 separate compliance tests were run on TMRS portfolios as of March 31, 2016.
- There were no active violations of TMRS guidelines.
Risk Management
Risk Management Overview
March 2016

• **Objective**
  – Identification, evaluation and management of all risks related to investment results.

• **Responsibilities:**
  – Defining the policy and strategy for investment risk management
  – Building a risk aware culture within the organization
  – Analytical tools for investment risk management
  – Reporting on investment risk to the Board

• **Risk Report: Q1 2016**
  – One year outlook market volatility has increased from year end but is still a lot lower than long term expectations
  – Forward looking Tracking Error has increased to 1.8% from 1.6%, with 1.1% due to pending policy allocations
<table>
<thead>
<tr>
<th>Topic</th>
<th>Update</th>
</tr>
</thead>
<tbody>
<tr>
<td>Board and Internal Risk Reporting</td>
<td>Providing quarterly Board Risk Reports for the total fund and internal asset class reports analyzing active risk taken by our public market managers.</td>
</tr>
<tr>
<td>Specialized Risk Analysis</td>
<td>Applying and further developing specialized risk analysis solutions for Alternative Asset Class investments</td>
</tr>
<tr>
<td>Performance Attribution</td>
<td>Performance Attribution allows us to better distinguish manager skill from luck by breaking down (attributing) monthly returns to specific manager decisions. Refining attribution measures, adding new accounts and strategies, and working on summary observations.</td>
</tr>
<tr>
<td>Data Management Solution for Account Related information</td>
<td>Narrowly focused Data Warehouse was developed to satisfy detailed portfolio data needs of the Performance Attribution System. Currently expanding Data Warehouse to cover all Account Related reporting needs, converting to more powerful IT platform and shifting Investment Data Analyst position to functionally report to the IS Department.</td>
</tr>
<tr>
<td>Performance Reporting</td>
<td>Expanding Performance Reporting procedures and methodology to incorporate new asset types, new investment vehicles, and increased transparency. Adding un-lagged performance reporting which will show returns for all accounts properly aligned with the time periods when they were earned.</td>
</tr>
<tr>
<td>Quantitative Portfolio Analysis</td>
<td>Monitoring advances in quantitative portfolio analysis to ensure that risk and performance analysis remain current at TMRS</td>
</tr>
</tbody>
</table>

1. Private market asset classes, like Real Estate, are priced quarterly with a quarter lag due to use of appraised value pricing in the absence of market prices. For some asset class funds in less liquid public markets this is also true, although to a lesser extent and the lag is only one month.
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Texas Municipal Retirement System

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