TENNESSEE CONSOLIDATED RETIREMENT SYSTEM

2012 ASSET/LIABILITY STUDY SUMMARY

STRATEGIC INVESTMENT SOLUTIONS, INC.

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Asset/Liability Study Outline

I. Asset allocation: develop a range of risk-efficient alternative asset mixes

II. Asset-liability integration
   A. Examine simulated outcomes
   B. Select asset mix that matches fiduciary risk tolerance

Asset Allocation Based on SIS Asset Class Expected Performance

- Long-Term Looking Forward (2-3 Market Cycles)
- Based on Available Histories
- Tendency to Utilize Mean Reversion
- Must "Behave" in an Optimization
  - Reasonable Portfolios
  - Stable Frontier
- Capital Asset Pricing Model (CAPM) Used to Price Difficult Assets
- Economic Forecasts
- Investment Policy Committee
- Return Estimates
  - Based upon Passive Index Returns
- Risk Estimates (Standard Deviation)
  - Monthly Observations Since 1976
  - Monthly Observations Since 1985 (Smoothed)
- Correlation Estimates
  - Monthly Observations Since 1985 (Smoothed)

Building-Block Approach to Standard Asset Class Expected Returns

ASSET CLASS	DERIVATION
Inflation	Consensus of Economists' Forecasts, TIPS
Cash	Inflation + 1% to 2% Premium
US Large Cap	CAPM, 3% to 6% Equity Premium, Macroeconomic Dividend Discount Model
US Fixed	Yield to Worst on Aggregate (Compare to Historic Bond Risk Premium, Adjust if Necessary)
US Small Cap	CAPM, (Beta of ~1.2)
Private Markets	CAPM, (Beta of ~1.6)
International Equity	Weighted Sum of Local Market Premium + Local Risk Free Rate
International Bond	US Fixed Return, Adjusted for Quality and Duration (Potential Currency Effects Based on Purchasing Power Parity)
Real Estate	Historical Behavior of Equity REITs; Current Appraisal Cap Rates; CAPM
High Yield	Historical Ratio: Spread of High Yield Over US Fixed Income Divided By Spread of Large Cap Over US Fixed Income

Asset Class Expectations Customized for TCRS

ASSET CLASS	DERIVATION
Core Bonds	Adjusted for differences between SIS & LPF index sector weights
Real Estate	30% opportunistic (SIS expected return + 200 bp)
Strategic Lending	50/50 blend of SIS high yield and bank loan expectations
Long Treasuries	Based on differences between SIS & BC Long Treasury index yields and historical risk

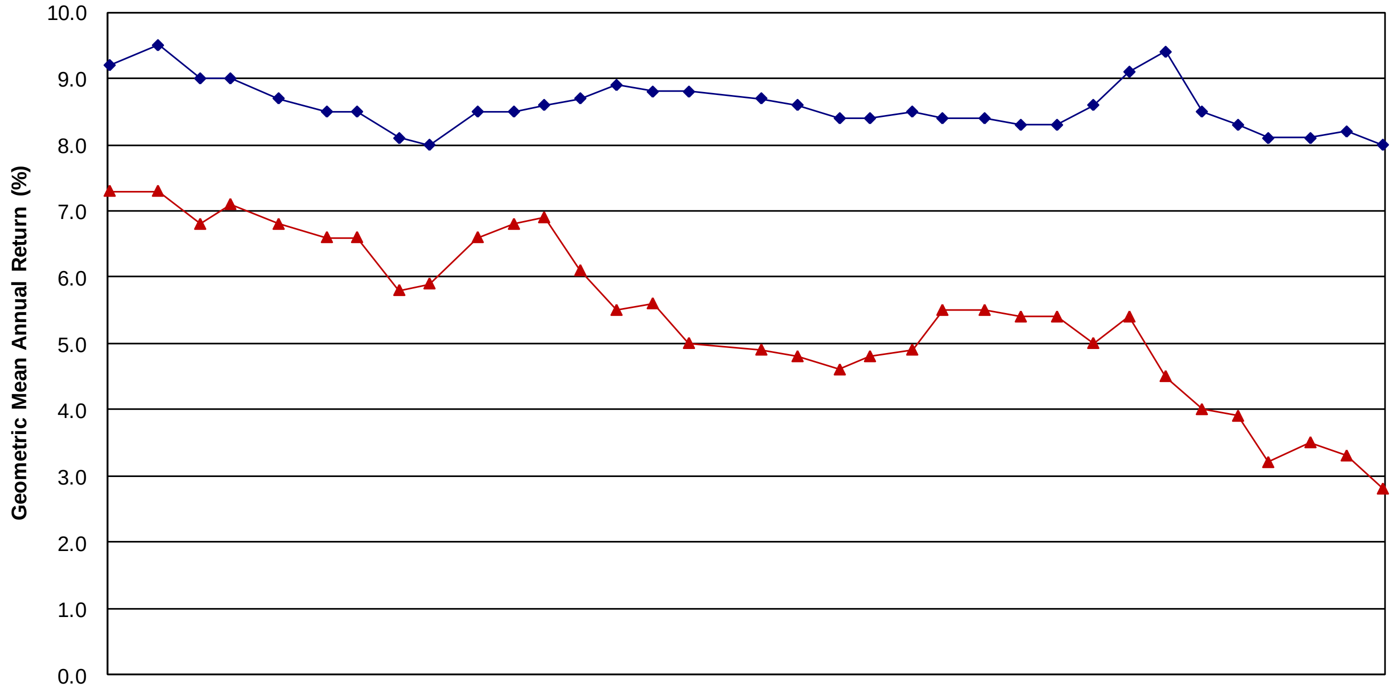
Current Asset Class Expected Returns & Risks

	Return	Risk
N. American Equity (Incl. 5% Canadian)	8.0%	18.0%
US Fixed Income	(see below)	
International Equity	8.0%	18.5%
Real Estate	7.2%	20.9%
Private Equity	10.5%	33.0%
Short Term	2.0%	1.0%
Emerging Market Equity	8.5%	27.5%
Strategic Lending	5.1%	8.5%
Hedge Funds	5.3%	10.0%
US Fixed Income	3.1%	5.9% *
Core Bonds	3.2%	6.8%
Inflation Hedged Bonds	2.7%	2.7%
Long Treasuries	3.4%	7.7%

* Assumes Inflation Hedged Bonds and Core Bonds in current proportions

Historical Downward Pressure on Expected Returns

History of SIS Expected Returns for US Stocks & Bonds



	Oct 94	Jun 95	Jan 96	Jun 96	Feb 97	Oct 97	Mar 98	Oct 98	Mar 99	Nov 99	May 00	Oct 00	Apr 01	Oct 01	Apr 02	Oct 02	Oct 03
US Large Cap	9.2	9.5	9.0	9.0	8.7	8.5	8.5	8.1	8.0	8.5	8.5	8.6	8.7	8.9	8.8	8.8	8.7
US Bonds	7.3	7.3	6.8	7.1	6.8	6.6	6.6	5.8	5.9	6.6	6.8	6.9	6.1	5.5	5.6	5.0	4.9

	Apr 04	Nov 04	Apr 05	Nov 05	Apr 06	Nov 06	May 07	Nov 07	May 08	Nov 08	May 09	Nov 09	May 10	Oct 10	May 11	Nov 11	May 12
US Large Cap	8.6	8.4	8.4	8.5	8.4	8.4	8.3	8.3	8.6	9.1	9.4	8.5	8.3	8.1	8.1	8.2	8.0
US Bonds	4.8	4.6	4.8	4.9	5.5	5.5	5.4	5.4	5.0	5.4	4.5	4.0	3.9	3.2	3.5	3.3	2.8

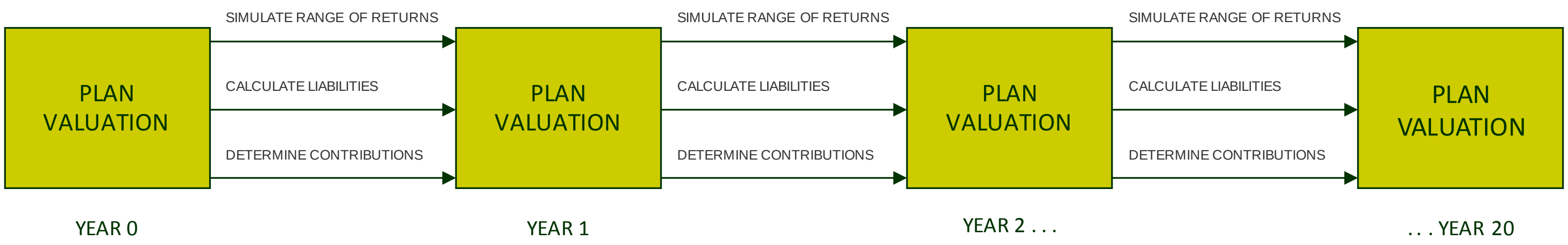
Specified Mixes

	Existing Normal	As-Allocated	Low Risk Normal	Median Normal	Median Mixed As-Allocated	Median Equity As-Allocated	High Return Normal	Constrained High Return	Modified As-Allocated	Long Run
N. American Equity (Incl. 5% Canadian)	40%	42%	32%	37%	40%	41%	40%	44%	49%	15%
US Fixed Income	34%	37%	34%	29%	30%	29%	25%	20%	20%	16%
International Equity	15%	16%	13%	13%	14%	14%	15%	15%	15%	15%
Real Estate	7%	4%	7%	7%	4%	4%	7%	7%	4%	11%
Private Equity	3%	0%	3%	3%	1%	1%	3%	3%	1%	11%
Short Term	1%	1%	1%	1%	1%	1%	0%	1%	1%	0%
Emerging Market Equity			5%	5%	5%	5%	5%	5%	5%	4%
Strategic Lending			5%	5%	5%	5%	5%	5%	5%	17%
Hedge Funds										11%
Return	6.9%	6.6%	6.8%	7.1%	6.9%	6.9%	7.3%	7.5%	7.3%	7.5%
Risk	11.8%	11.2%	11.4%	12.1%	11.8%	12.0%	12.9%	13.5%	13.4%	12.9%
Total Public Equity	55%	58%	50%	55%	59%	60%	60%	64%	69%	34%
Total Private Equity + Strategic Lending	3%	0%	8%	8%	6%	6%	8%	8%	6%	28%
US Fixed Income										
Core Bonds	26%	29%	26%	22%	23%	22%	18%	15%	15%	
Inflation Hedged Bonds	8%	8%	8%	7%	7%	7%	7%	5%	5%	
Long Treasuries										17%

Optimized Mixes (Risk Levels for Simulation)

	Existing Normal	6½% Mix	6¾% Mix	7% Mix	7¼% Mix	7½% Mix	Constraints
N. American Equity (Incl. 5% Canadian)	40%	25%	29%	32%	37%	42%	
US Fixed Income	34%	41%	36%	31%	24%	19%	
International Equity	15%	15%	15%	15%	15%	15%	Max 15%
Real Estate	7%	5%	6%	8%	10%	10%	Max 10%
Private Equity	3%	3%	3%	3%	3%	3%	
Short Term	1%	1%	1%	1%	1%	1%	Min 1%
Emerging Market Equity		5%	5%	5%	5%	5%	ACWIxUS weight
Strategic Lending		5%	5%	5%	5%	5%	Min 5%
Hedge Funds							
Return	6.9%	6.5%	6.7%	7.0%	7.3%	7.5%	
Risk	11.8%	10.3%	11.1%	11.9%	12.7%	13.6%	
Total Public Equity	55%	45%	49%	52%	57%	62%	
Total Private Equity + Strategic Lending	3%	8%	8%	8%	8%	8%	Max 8%
US Fixed Income							
Core Bonds	26%	31%	27%	23%	18%	14%	
Inflation Hedged Bonds	8%	10%	9%	8%	6%	5%	Min Current Proportion of USFI
Long Treasuries							

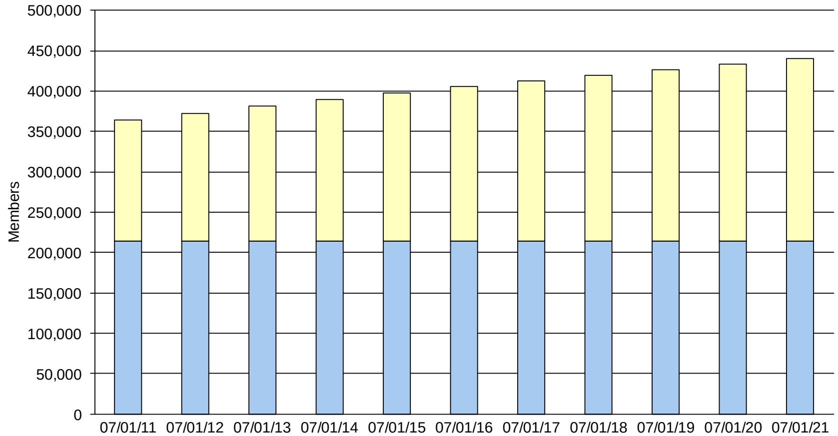
Simulating the Performance of Existing & Alternative Asset Mixes



- Monte Carlo: 5000 random multi-year outcomes
- Start with July 1, 2011 actuarial valuation date
- Calibrated to actuary’s benefit & liability projections
- Default annual workforce growth assumption of 0%
- Assume continuation of existing 7.5% discount rate
- Discount rate need not match SIS expected return:
  - Difference in forecast horizon: SIS = long-term, discount rate = very long term
  - SIS expected returns assume index-like investments
- Focus on outcomes at five-year planning horizon (July 1, 2017)

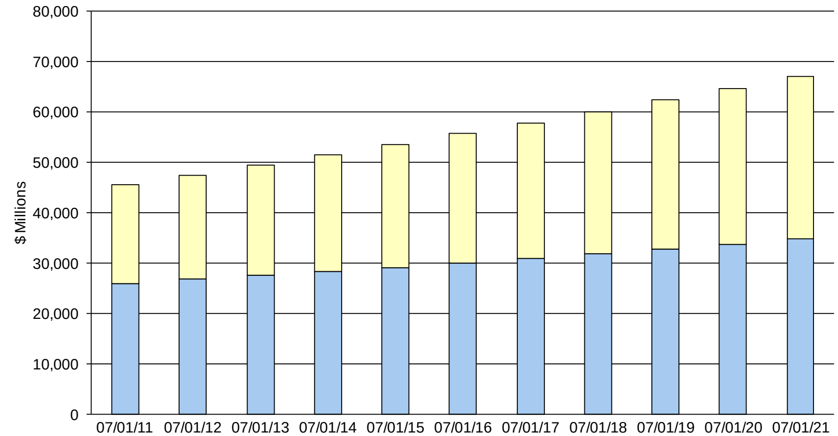
Constant-Rate Projections

Expected Plan Membership



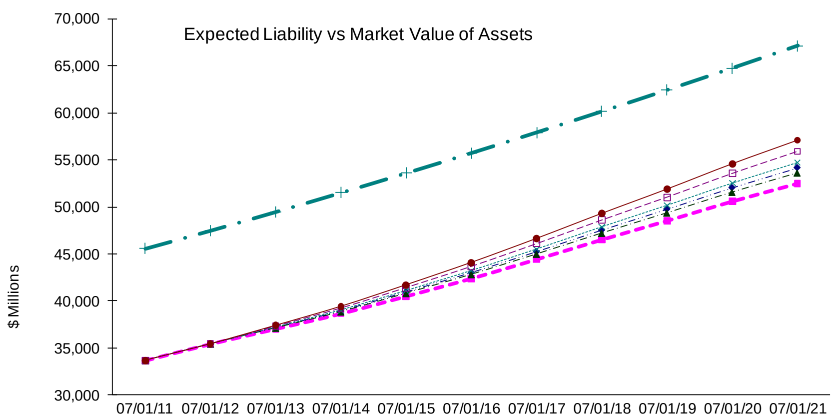
	07/01/11	07/01/12	07/01/13	07/01/14	07/01/15	07/01/16	07/01/17	07/01/18	07/01/19	07/01/20	07/01/21
Retired	149,806	157,861	166,294	174,611	182,711	190,511	198,051	205,308	212,266	218,909	225,320
Active	215,076	215,076	215,076	215,076	215,076	215,076	215,076	215,076	215,076	215,076	215,076

Expected Liability (PVB)



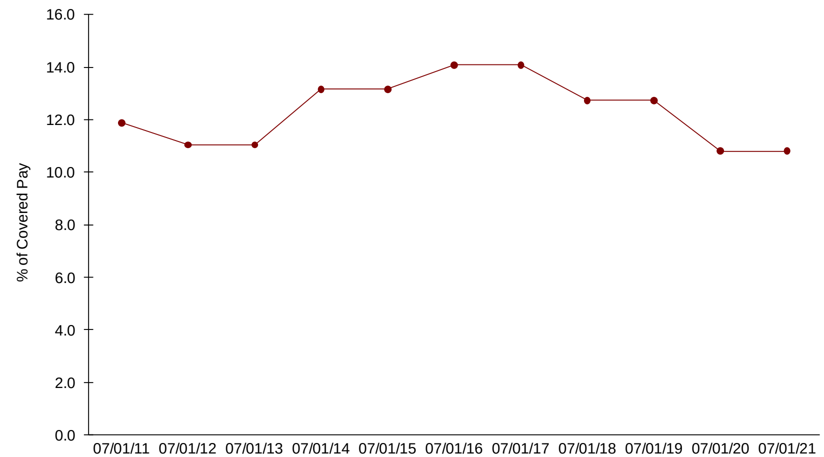
	07/01/11	07/01/12	07/01/13	07/01/14	07/01/15	07/01/16	07/01/17	07/01/18	07/01/19	07/01/20	07/01/21
Retired	19,512	20,655	21,860	23,110	24,400	25,697	26,983	28,292	29,621	30,966	32,325
Active	26,042	26,818	27,601	28,387	29,187	30,030	30,933	31,856	32,803	33,789	34,802

Expected Liability vs Market Value of Assets



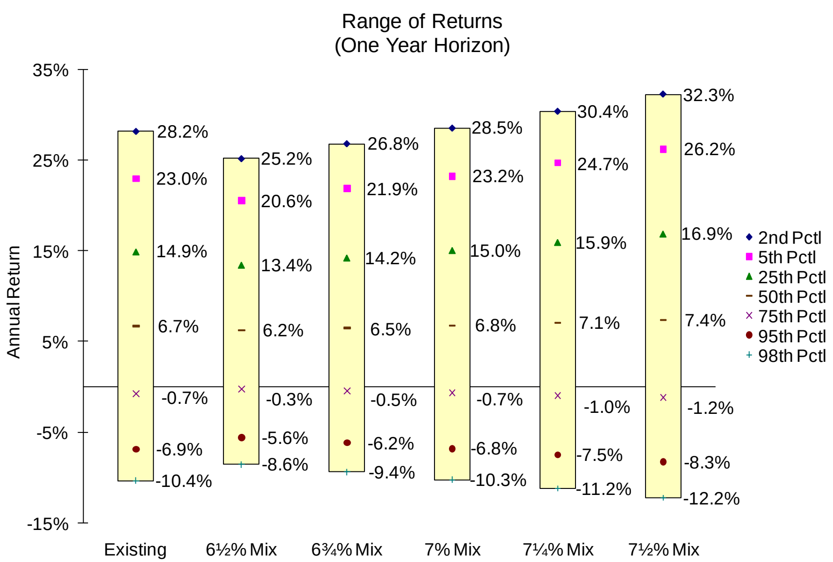
	07/01/11	07/01/12	07/01/13	07/01/14	07/01/15	07/01/16	07/01/17	07/01/18	07/01/19	07/01/20	07/01/21
Existing	33,662	35,419	37,159	38,933	40,945	43,016	45,242	47,539	49,760	52,044	54,162
6½% Mix	33,662	35,419	37,027	38,653	40,504	42,394	44,433	46,523	48,537	50,595	52,496
6¾% Mix	33,662	35,419	37,114	38,838	40,795	42,804	44,966	47,192	49,342	51,548	53,591
7% Mix	33,662	35,419	37,202	39,023	41,089	43,218	45,506	47,873	50,162	52,522	54,713
7¼% Mix	33,662	35,419	37,292	39,216	41,395	43,651	46,072	48,587	51,024	53,549	55,898
7½% Mix	33,662	35,419	37,382	39,406	41,696	44,078	46,632	49,295	51,882	54,572	57,083
Liability	45,554	47,474	49,461	51,497	53,587	55,727	57,916	60,147	62,424	64,754	67,127

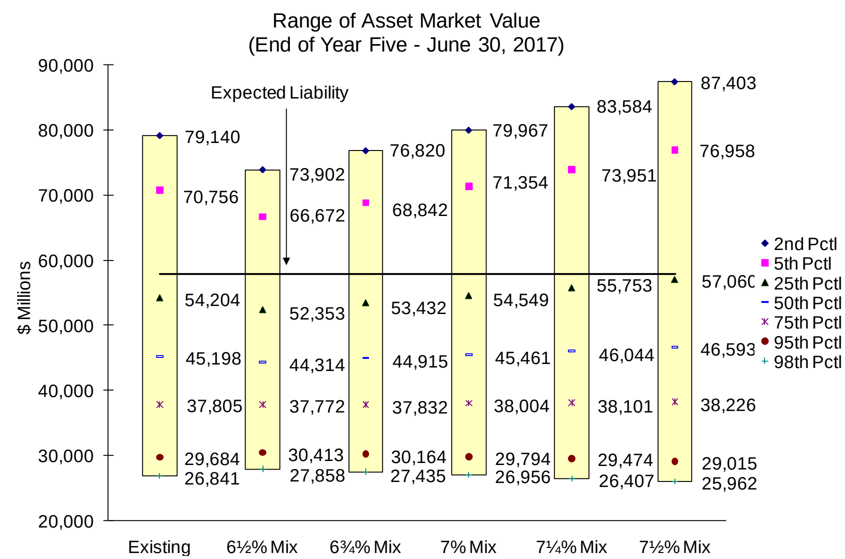
Expected Employer Contribution as % of Pay
(Existing Normal)

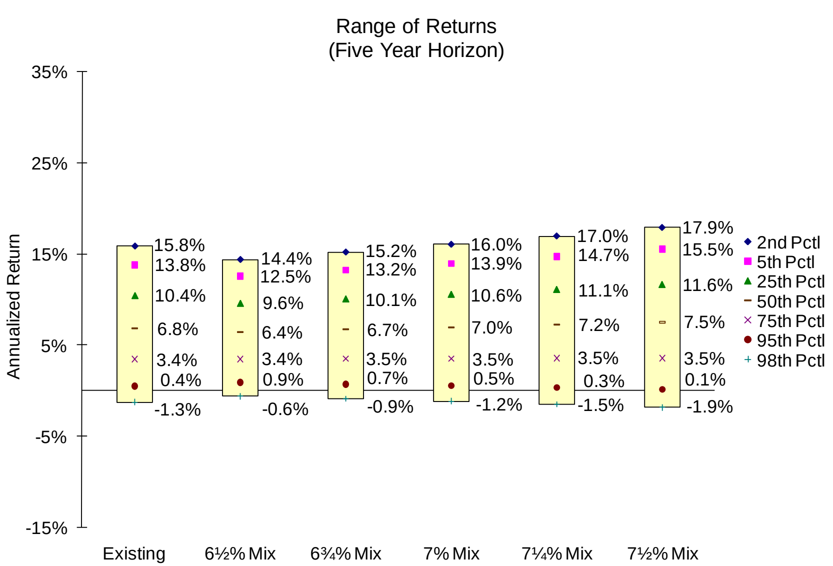


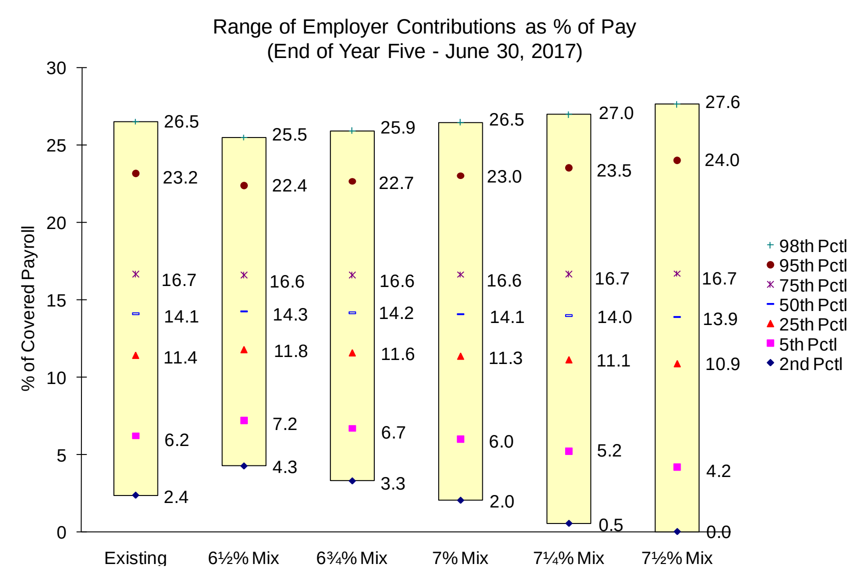
	07/01/11	07/01/12	07/01/13	07/01/14	07/01/15	07/01/16	07/01/17	07/01/18	07/01/19	07/01/20	07/01/21
Contrib %	11.9	11.0	11.0	13.2	13.2	14.1	14.1	12.7	12.7	10.8	10.8

Range of Returns, Market Value, & Contributions

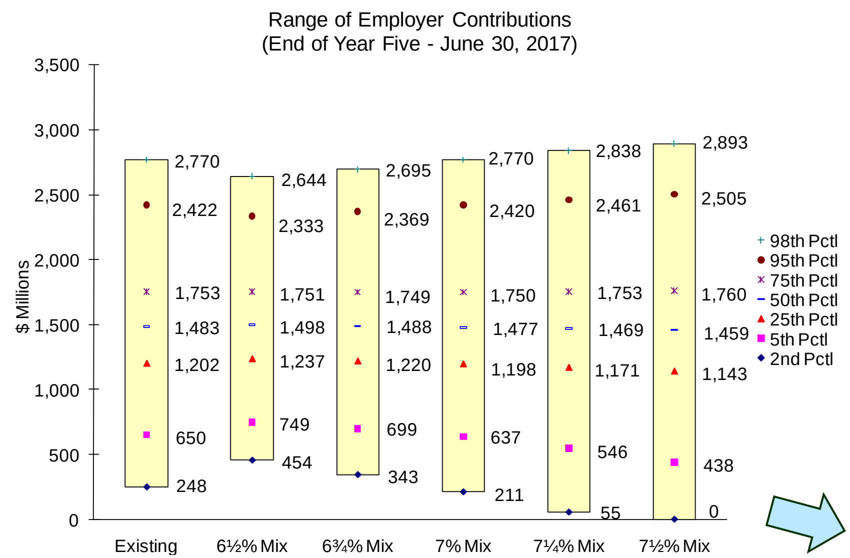


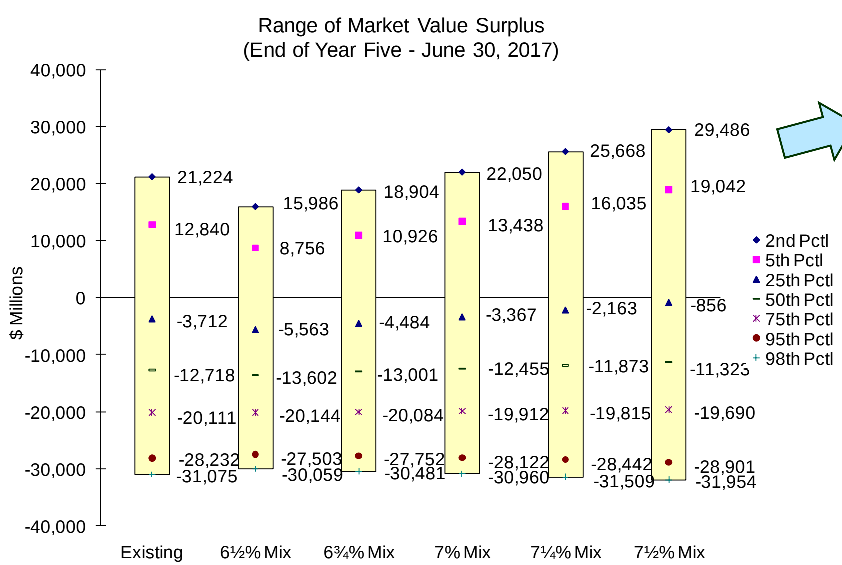


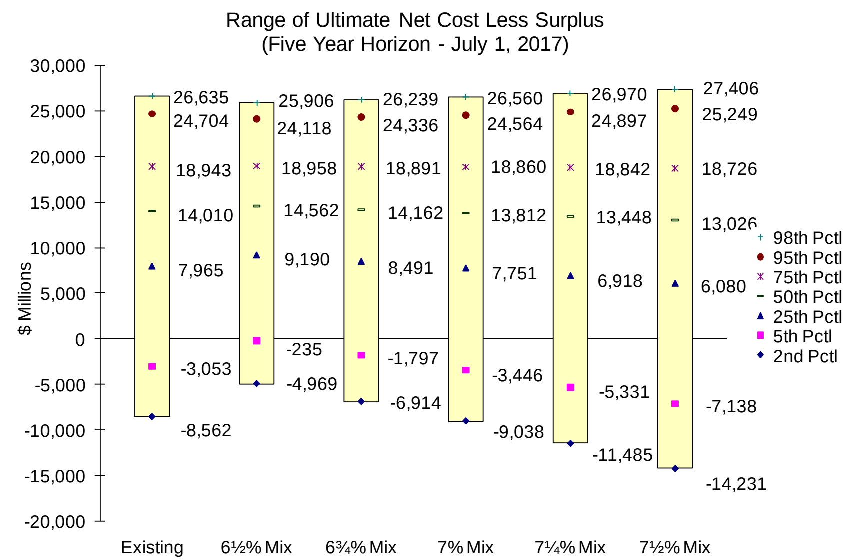




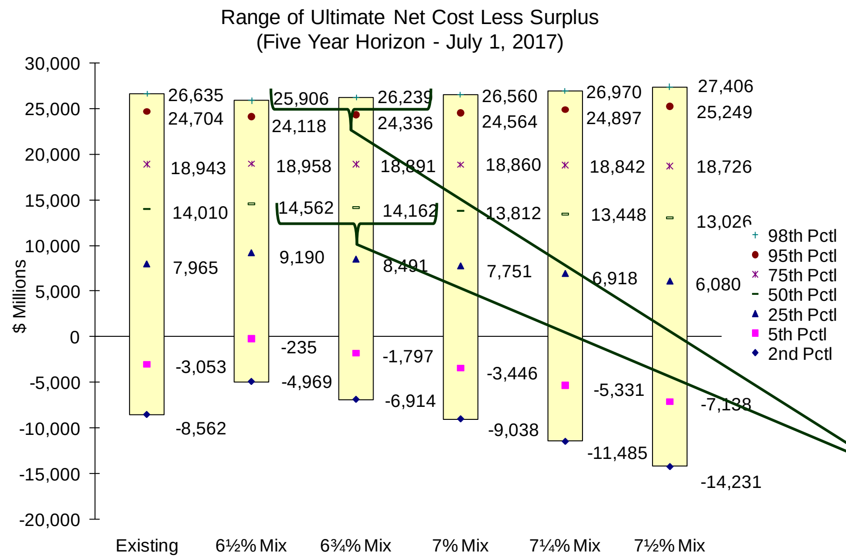
“Ultimate Net Cost” = Present Value of Contributions & Unfunded Liability

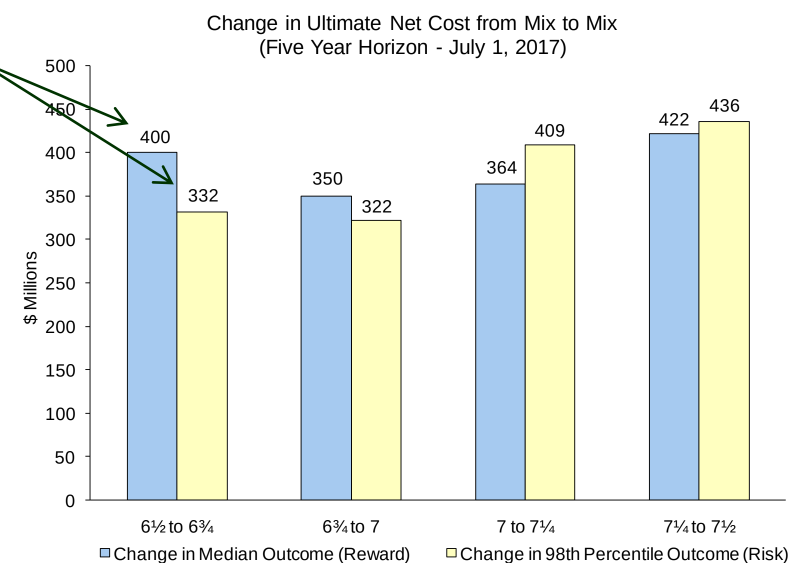




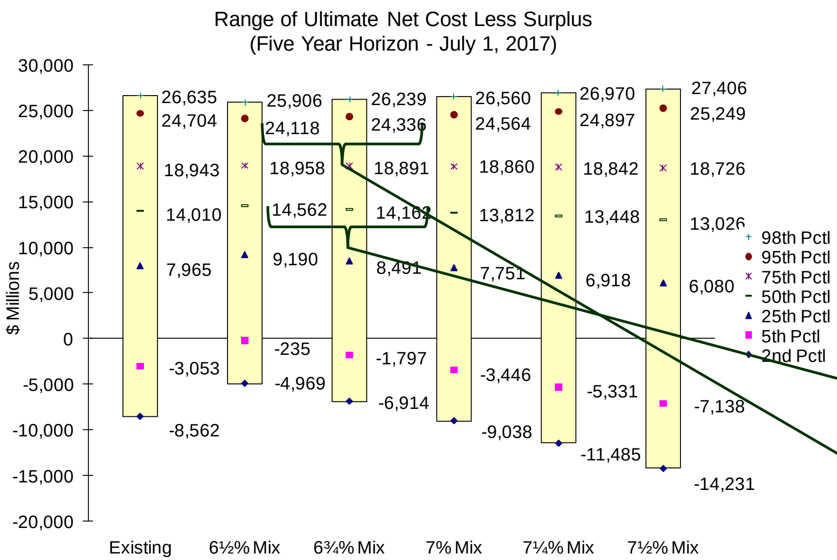


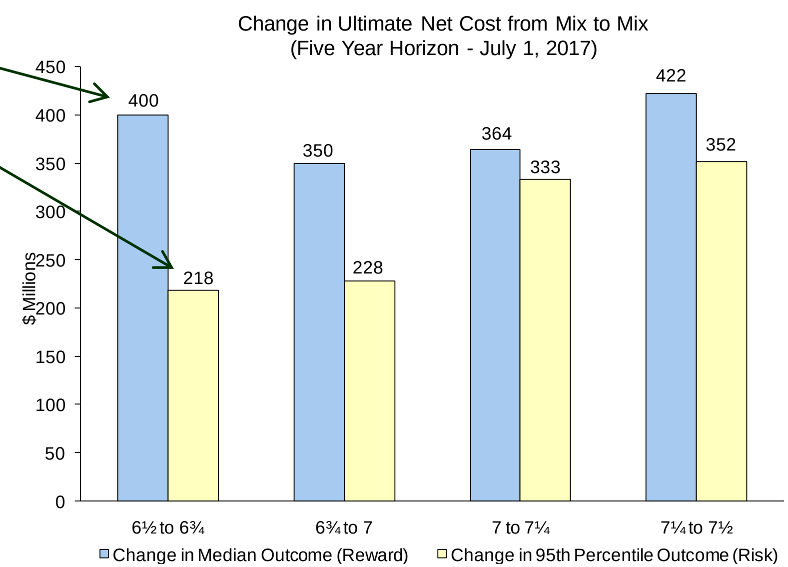
Ultimate Net Cost Trade-Off from Mix to Mix Is Favorable Up to the 7% Mix at a Five-Year Horizon, Given a Conservative Risk Tolerance (98th Percentile)





Ultimate Net Cost Trade-Off from Mix to Mix Is Favorable Up to the 7½% Mix, Given a More Typical Risk Tolerance (95th Percentile)





Conclusions

1) At the current expected return level (7%), the fund would be a bit more risk-efficient (higher Sharpe Ratio), and with a slightly higher expected return, with less allocated to North American Equity and TIPS, and with new allocations to Emerging Market Equity and Strategic Lending.

2) Keeping the fund at the current expected return level (7%) has a favorable risk/reward tradeoff given a conservative risk tolerance.

3) Raising the fund's expected return to 7½% has a favorable risk/reward tradeoff (with a more typical risk tolerance level), and retains all of the North American Equity exposure, but requires a large increase in Real Estate, which may not be implementable in the near term, and large reduction in US Fixed Income.

	Existing Normal	Rec Mix	7¼% Mix	7½% Mix
N. American Equity (Incl. **4%** Canadian)	40%	37%	37%	42%
US Fixed Income	34%	29%	24%	19%
International Equity	15%	13%	15%	15%
Real Estate	7%	7%	10%	10%
Private Equity	3%	3%	3%	3%
Short Term	1%	1%	1%	1%
Emerging Market Equity		5%	5%	5%
Strategic Lending		5%	5%	5%
Hedge Funds				
Return	6.9%	7.1%	7.3%	7.5%
Risk	11.8%	12.1%	12.7%	13.6%
Total Public Equity	55%	55%	57%	62%
Total Private Equity + Strategic Lending	3%	8%	8%	8%
US Fixed Income				
Core Bonds	26%	25%	18%	14%
Inflation Hedged Bonds	8%	4%	6%	5%