UTAH DEPARTMENT OF TRANSPORTATION NET PRESENT VALUE OF BONDING SCENARIOS

EXECUTIVE APPROPRIATIONS COMMITTEE
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ISSUE BRIEF

SUMMARY

A commonly asked question when the subject of bonding for transportation comes up is: "Do the benefits of accelerating transportation projects through bonding offset the issuance and interest costs associated with bonding?" This brief examines this question by comparing the net present value (NPV) of potential 10-year and 15-year interest costs against the positive benefits of construction employment, congestion savings, and potential economic development.

In our analysis, the answer to the posed question is that in all cases, the cost of financing outweighs the benefits of less congestion, construction multipliers, and accelerated economic growth. A summary of the results is given in Table 1 for the 24 possible scenarios.

In Table 1, the difference between the real present value of interest costs (PV Cost) and the real present value of benefits (PV Benefits) equal the NPV (Net). For example, when looking at the left side of the table, "10-Year Bonding Scenarios" [1] and Scenario 1 under Current Conditions, by adding ($97,996,636) and $30,522,324, the sum is ($67,474,312). Each scenario in Table 1 shows a negative number, this indicates that accelerating construction for transportation projects does not offset financing costs based on the factors used in this analysis.

Table 1 - Summary Net Present Value Results

Results Matrix, 10-Year Bonding Scenarios				Results Matrix, 15-Year Bonding Scenarios			
Current Conditions				**Current Conditions**			
	PV Cost	PV Benefits	Net		PV Cost	PV Benefits	Net
Scenario 1	($97,996,636)	$30,522,324	($67,474,312)	Scenario 1	($120,908,372)	$30,638,703	($90,269,669)
Scenario 2	($106,064,915)	$51,580,344	($54,484,572)	Scenario 2	($130,635,767)	$51,390,613	($79,245,154)
Scenario 3	($139,304,112)	$65,680,867	($73,623,245)	Scenario 3	($172,070,349)	$65,452,816	($106,617,533)
Scenario 4	($215,243,625)	$102,822,063	($112,421,563)	Scenario 4	($266,637,241)	$102,420,878	($164,216,363)
Accelerated Growth				**Accelerated Growth**			
	PV Cost	PV Benefits	Net		PV Cost	PV Benefits	Net
Scenario 1	($112,696,131)	$29,259,836	($83,436,296)	Scenario 1	($139,044,628)	$29,365,922	($109,678,706)
Scenario 2	($121,974,653)	$50,217,456	($71,757,197)	Scenario 2	($150,231,132)	$50,016,573	($100,214,559)
Scenario 3	($160,199,728)	$63,886,365	($96,313,364)	Scenario 3	($197,880,901)	$63,644,437	($134,236,464)
Scenario 4	($247,530,169)	$99,962,099	($147,568,071)	Scenario 4	($306,632,827)	$99,542,259	($207,090,568)
Recessionary Decline				**Recessionary Decline**			
	PV Cost	PV Benefits	Net		PV Cost	PV Benefits	Net
Scenario 1	($93,096,804)	$31,784,813	($61,311,991)	Scenario 1	($114,862,954)	$31,911,485	($82,951,469)
Scenario 2	($100,761,670)	$52,943,231	($47,818,438)	Scenario 2	($124,103,979)	$52,764,654	($71,339,325)
Scenario 3	($132,338,906)	$67,475,369	($64,863,537)	Scenario 3	($163,466,831)	$67,261,195	($96,205,637)
Scenario 4	($204,481,444)	$105,682,027	($98,799,417)	Scenario 4	($253,305,379)	$105,299,496	($148,005,883)

Description of Scenarios

- Scenario 1: Moves up spending on I-15 in Utah County by two years from the current project schedule;
- Scenario 2: Adds upon Scenario 1 by moving up I-15 in Salt Lake County by one year;
- Scenario 3: Adds upon Scenario 2 by moving up I-15 in Davis County by three years; and
- Scenario 4: Adds upon Scenario 3 by including an additional $710 million in various other projects across the State starting in FY 2019 (see page 5 for additional detail on scenario changes).

[1] 10-year bonding scenarios were analyzed with 10-year net present value time-horizons; 15-year bonding scenarios were analyzed with 15-year net present value time-horizons.

BACKGROUND

During the 2016 General Session, the Legislature passed the following intent language (H.B. 3, Item 63):

> *The Legislature intends that the Utah Department of Transportation prepare an analysis and financial report on the possibility of advancing construction of road projects currently programmed in the Transportation Investment Fund. The analysis should include consideration of the savings or additional costs associated with advancing the projects through the use of either short term debt or long term financing. The report should be reported to the Executive Appropriations Committee on or before the July 2016 legislative interim committee meetings.*

The Utah Department of Transportation (UDOT), in consultation with Zions Public Finance, Inc. (the State's contracted consultant) and the State Treasurer, prepared an analysis and financial report that includes four bonding scenarios and associated bond proceeds and new debt, if issued. Additionally, their analysis includes estimated outstanding debt and constitutional debt limits under each scenario. The Legislative Fiscal Analyst added to this study by looking at 10-year and 15-year NPVs of each of the scenarios.

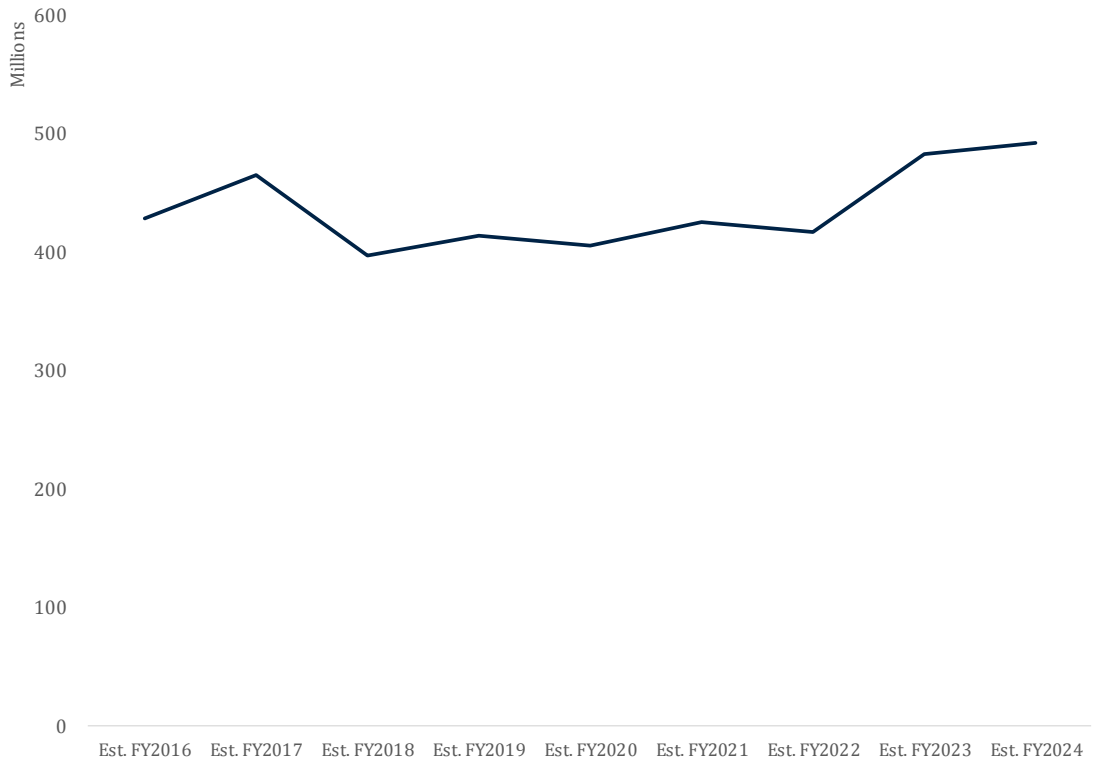
NPV evaluates the cost of a project and its associated benefits across time. A positive NPV means that the benefits of a project outweigh the costs of a project over the specified time period. In our current study, the costs of bonding are weighted against the benefits of increased income and employment in the construction sector, time-savings from reducing congestion, and potential economic development effects.

Current Spending and Borrowing

This subsection shows the current spending and borrowing picture by UDOT for the Transportation Investment Fund (TIF).

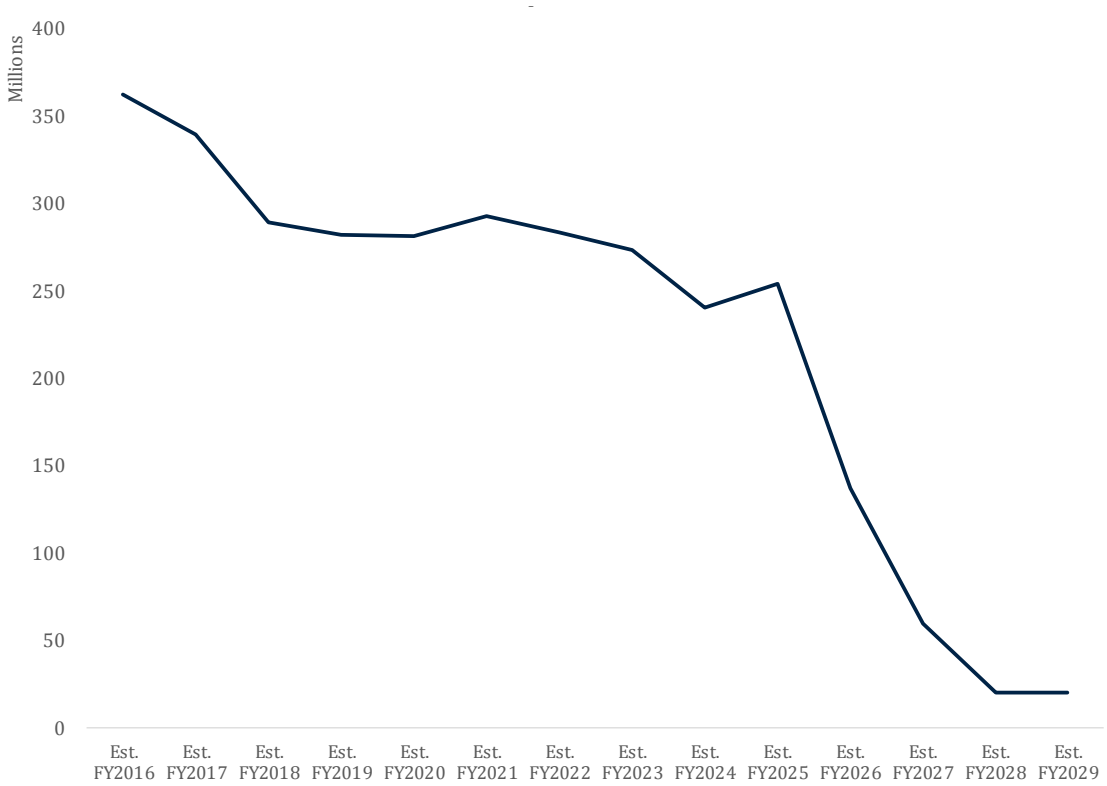
Figure 1 contains the current expenditure outlook based on current trends. Current expenditures in the TIF range from approximately $400 to $500 million through FY 2024. The slight rise from FY 2016 to FY 2017 is due to carry forward balances in the fund. The jump from FY 2022 to FY 2023 is due to the retirement of debt, freeing-up revenue for increased expenditures.

Figure 1 - Current Outlook on Transportation Investment Fund Expenditures



When looking at bonding, Figure 2 shows the current debt expense outlook through FY 2029. Debt repayment in FY 2016 is $362 million. Current debt repayment continues on a declining path until all TIF debt is completely retired by FY 2030.

Figure 2 - Current Debt on Transportation Investment Fund



ANALYSIS

The Analyst ran 24 possible scenarios based upon the four construction scenarios prepared by UDOT and the two bonding scenarios prepared by Zions Public Finance, Inc. (10-year and 15-year). For each of the four scenarios, three growth assumptions were used to determine NPV:

1. Current Conditions – assumes economic growth based on current conditions, or the status quo;
2. Accelerated Growth – assumes economic growth greater than the status quo by approximately two percent; and
3. Recessionary Decline – assumes economic growth lower than the status quo by approximately two percent.

Favorable and Unfavorable Factors to Net Present Value

The left-hand side of Table 2 contains factors that are favorable to finding a positive NPV. These factors include a stronger economic response from construction spending, a higher time savings from lower congestion, increased economic development, savings on construction inflation, and freeing up cash revenue for other projects.

The right-hand side of Table 2 contains factors that are unfavorable to finding a positive NPV. These factors include costs associated with the project itself and financing the project, such as issuance and interest.

Table 2 – Net Present Value Evaluation Factors

Factors *favorable* to NPV:	**Factors *unfavorable* to NPV:**
Stronger multiplier associated with construction and development (revenue from building)	Cost of the project(s)
Lower congestion/commute times	Cost of financing (issuance costs)
Economic effects beyond time savings	Interest expense in years out (opportunity cost; reduces available funding in years out)
Higher construction inflation in years out (saving money tomorrow by building today)	
Bonding today frees-up money for other time savings/economic-advantage-offering projects	

Assumptions

The following subsections address the assumptions used in this study. These include: 1) Scenarios, 2) Costs, and 3) Benefits.

Scenarios

The analysis includes four scenarios:

- Scenario 1: Moves up spending on I-15 in Utah County by two years from the current project schedule;
- Scenario 2: Adds upon Scenario 1 by moving up I-15 in Salt Lake County by one year;
- Scenario 3: Adds upon Scenario 2 by moving up I-15 in Davis County by three years; and
- Scenario 4: Adds upon Scenario 3 by including an additional $710 million in various other projects across the State starting in FY 2019.

A summary of the spending changes is also given in Table 3. The first three rows of Table 3 show UDOT's current project schedule and the rows below show each of the changes in the various scenarios, as noted above. For example, when looking at Scenario 1 compared to the Current Project Schedule, only I-15 Utah County changes. The finished project is moved up by two years, from FY 2022 to FY 2020.[2]

Table 3 - Summary of Spending Changes by Scenario

Current Project Schedule

	Total	FY2017	FY2018	FY2019	FY2020	FY2021	FY2022	FY2023
I-15 Utah County	$ 450,000,000	12,455,000	6,500,000	2,141,000	14,250,000	150,600,000	264,054,000	
I-15 Salt Lake County	$ 175,000,000	11,000,000	56,000,000	42,000,000	43,000,000	23,000,000		
I-15 Davis County	$ 150,000,000					6,000,000	59,000,000	85,000,000

Scenario 1

	Total	FY2017	FY2018	FY2019	FY2020	FY2021	FY2022	FY2023
I-15 Utah County	$ 420,000,000	20,000,000	110,000,000	190,000,000	100,000,000	-	-	
I-15 Salt Lake County	$ 175,000,000	11,000,000	56,000,000	42,000,000	43,000,000	23,000,000		
I-15 Davis County	$ 150,000,000					6,000,000	59,000,000	85,000,000

Scenario 2

	Total	FY2017	FY2018	FY2019	FY2020	FY2021	FY2022	FY2023
I-15 Utah County	$ 420,000,000	20,000,000	110,000,000	190,000,000	100,000,000	-	-	
I-15 Salt Lake County	$ 175,000,000	13,000,000	50,000,000	95,000,000	17,000,000	-		
I-15 Davis County	$ 150,000,000					6,000,000	59,000,000	85,000,000

Scenario 3

	Total	FY2017	FY2018	FY2019	FY2020	FY2021	FY2022	FY2023
I-15 Utah County	$ 420,000,000	20,000,000	110,000,000	190,000,000	100,000,000	-	-	
I-15 Salt Lake County	$ 175,000,000	13,000,000	50,000,000	95,000,000	17,000,000	-		
I-15 Davis County	$ 140,000,000		6,000,000	90,000,000	44,000,000	-	-	-

Scenario 4

	Total	FY2017	FY2018	FY2019	FY2020	FY2021	FY2022	FY2023
I-15 Utah County	$ 420,000,000	20,000,000	110,000,000	190,000,000	100,000,000	-	-	
I-15 Salt Lake County	$ 175,000,000	13,000,000	50,000,000	95,000,000	17,000,000	-		
I-15 Davis County	$ 140,000,000		6,000,000	90,000,000	44,000,000	-	-	-
Other Projects	$ 710,000,000			35,000,000	210,000,000	245,000,000	220,000,000	

[2] Spending does not equally move up in each scenario due to construction constraints.

Costs

Cost assumptions include the marginal changes of bonding issuance, namely incurred interest expenses and the cost of bond issuance.

Table 4 provides a comparison of the current debt spending (second column from the left) trend with the four considered scenarios across time for 10-year bonds.[3] The difference between the scenarios depends upon when bonds are issued and how quickly they are paid off.

Overall, currently programmed debt expenditures are $3.13 billion. On the whole, Scenario 1 increases the debt spending to $3.60 billion; Scenario 2 increases the debt spending to $3.64 billion; Scenario 3 to $3.80 billion; and Scenario 4 to $4.21 billion.

Table 4 - Debt Expenditures by Current and Alternative Bonding Scenarios

Fiscal Year	Current Program	Bonding Scenario 1	Bonding Scenario 2	Bonding Scenario 3	Bonding Scenario 4
FY 2016	$362,332,135	$362,332,135	$362,332,135	$362,332,135	$362,332,135
FY 2017	$339,348,188	$339,475,188	$339,509,063	$339,509,063	$339,517,563
FY 2018	$289,067,451	$291,960,326	$292,006,576	$292,325,201	$292,176,701
FY 2019	$282,133,282	$298,422,907	$299,077,157	$302,534,532	$302,421,407
FY 2020	$281,010,065	$316,998,340	$321,912,315	$333,857,315	$341,789,065
FY 2021	$292,464,198	$338,670,873	$342,338,948	$358,204,198	$387,630,698
FY 2022	$283,077,796	$329,241,971	$332,899,921	$348,767,421	$388,713,796
FY 2023	$273,445,341	$319,570,491	$323,231,091	$339,079,216	$378,986,716
FY 2024	$240,593,102	$286,680,602	$290,334,227	$306,165,477	$346,042,977
FY 2025	$253,905,104	$299,950,229	$303,594,229	$319,419,354	$359,262,229
FY 2026	$137,181,875	$183,174,875	$186,817,125	$202,620,500	$242,430,625
FY 2027	$59,323,000	$105,269,625	$108,912,375	$124,702,000	$164,467,750
FY 2028	$20,077,000	$65,334,500	$68,799,125	$84,566,375	$124,253,375
FY 2029	$20,050,000	$53,917,250	$58,008,875	$72,149,750	$112,774,375
FY 2030	$0	$12,633,125	$11,095,625	$15,949,000	$52,304,500
FY 2031	$0	$0	$0	$0	$13,002,125
Total	$3,134,008,537	$3,603,632,437	$3,640,868,787	$3,802,181,537	$4,208,106,037

[3] The 15-year debt table is similar, with the debt costs increasing. For example, Scenario 1's debt increases from $3.60 billion in the 10-year scenario to $3.62 billion.

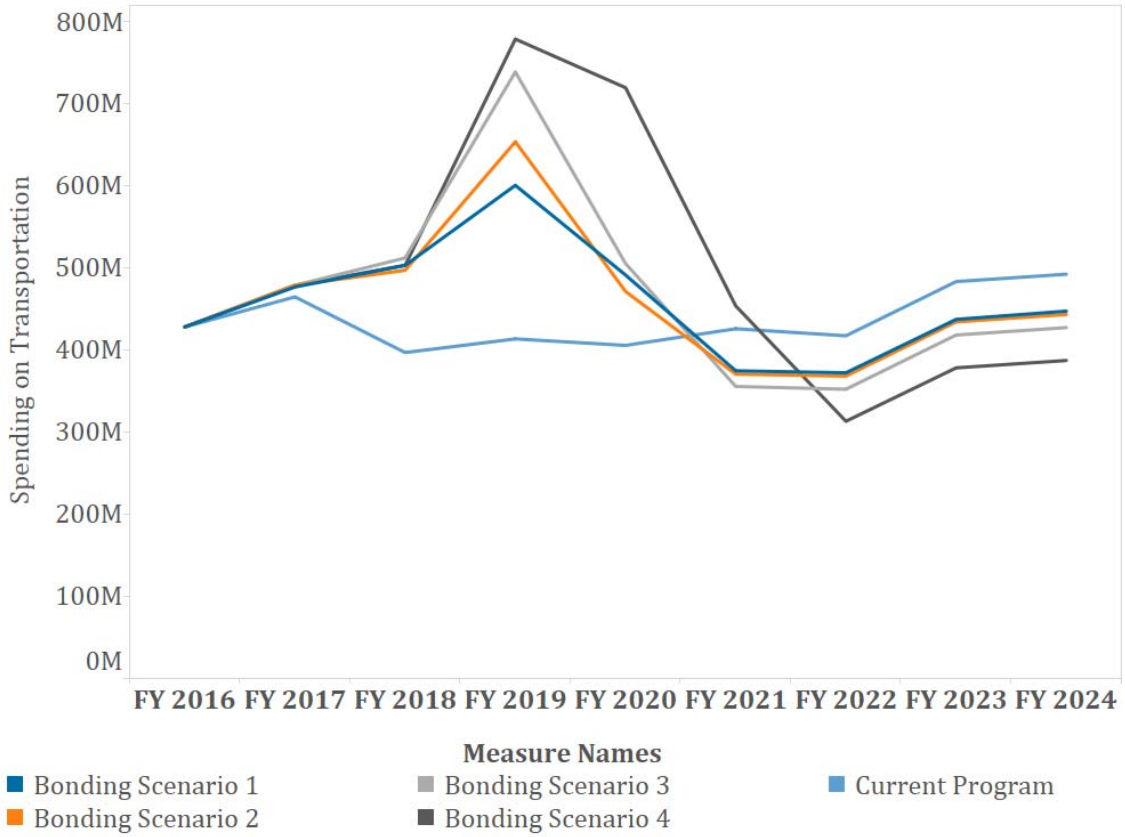
Table 5 shows the expenditures for the 10-year bonding scenarios.[4] On the whole, the current expenditure path has $3.93 billion in spending from FY 2016 to FY 2024 (second column from the left). The alternative scenarios increase the spending, with Scenario 1 spending at $4.13 billion, Scenario 2 spending at $4.14 billion, Scenario 3 spending at $4.21 billion, and Scenario 4 spending at $4.44 billion.

Table 5 - Spending on Highway Construction by Current and Alternative Bonding Scenarios

Fiscal Year	Current Program	Bonding Scenario 1	Bonding Scenario 2	Bonding Scenario 3	Bonding Scenario 4
FY 2016	$427,783,883	$427,783,883	$427,783,883	$427,783,883	$427,783,883
FY 2017	$464,389,965	$476,451,965	$478,451,965	$478,451,965	$478,451,965
FY 2018	$396,645,044	$502,785,044	$496,785,044	$511,785,044	$502,785,044
FY 2019	$413,253,166	$600,163,166	$653,163,166	$738,163,166	$778,163,166
FY 2020	$405,358,132	$491,008,132	$471,008,132	$505,008,132	$719,008,132
FY 2021	$425,636,486	$374,396,800	$370,396,800	$355,396,800	$453,396,800
FY 2022	$417,054,000	$372,000,000	$368,000,000	$352,000,000	$313,000,000
FY 2023	$483,000,000	$437,000,000	$434,000,000	$418,000,000	$378,000,000
FY 2024	$492,000,000	$447,000,000	$443,000,000	$427,000,000	$387,000,000
Total	$3,925,120,676	$4,128,588,990	$4,142,588,990	$4,213,588,990	$4,437,588,990

The change in spending by bonding shifts the expenditure path from a relatively smooth outlook to one with more peaks and valleys, as illustrated in Figure 3. The light blue line in Figure 3 is the current program; Scenario 4 (scenario with the most spending and the highest interest expense) is the dark gray line with the most significant peaks and valleys.

Figure 3 - Changes in Transportation Spending and Alternative Bonding Scenarios



[4] As with the previous debt picture, the expenditure picture for the 15-year bonding scenarios is similar, with greater expense in the out-years on interest costs.

Benefits

This section presents the potential benefits of accelerating construction projects through bonding, which include two broad areas. First, the direct construction employment and income from the increased expenditures, and second, the indirect benefits from time-savings on congestion and the associated potential economic development.

Addressing the direct construction effect first, Table 6 presents the estimated state revenue gains to the General and Education Funds from the increased construction spending over the next several years by economic assumption. The increase in revenue primarily comes from sales and income taxes associated with the construction and the employment of individuals.

The revenue increase ranges from a low of approximately $320,000 in FY 2017 for "Scenario 1: Accelerated Growth's to a high of almost $18 million in FY 2019 for "Scenario 4: Recessionary Decline."

The models assume transportation spending multipliers change across time by a five percent differential. This means that when times are good ("Accelerated Growth"), highway construction multipliers may be lower, potentially negligible. When economic conditions enter a recession ("Recessionary Decline"), highway construction multipliers may be higher. In this analysis, the assumption is that when the economy is in a recession, the multiplier is higher by five percent, but if the economy accelerated, the multiplier is five percent lower. [5]

Table 6 - General Fund/Education Fund Revenue from Increased Transportation Spending

Scenario and Economic Assumption	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021
Scenario 1: Current Conditions	$336,750	$4,657,240	$9,034,450	$5,498,465	$3,624,170
Scenario 1: Accelerated Growth	$319,913	$4,424,378	$8,582,728	$5,223,542	$3,442,962
Scenario 1: Recessionary Decline	$353,588	$4,890,102	$9,486,173	$5,773,388	$3,805,379
Scenario 2: Current Conditions	$426,010	$4,403,485	$11,350,705	$4,676,620	$4,161,255
Scenario 2: Accelerated Growth	$404,710	$4,183,311	$10,783,170	$4,442,789	$3,953,192
Scenario 2: Recessionary Decline	$447,311	$4,623,659	$11,918,240	$4,910,451	$4,369,318
Scenario 3: Current Conditions	$426,012	$4,670,566	$15,375,573	$7,232,474	$5,181,078
Scenario 3: Accelerated Growth	$404,711	$4,437,038	$14,606,794	$6,870,850	$4,922,024
Scenario 3: Recessionary Decline	$447,313	$4,904,094	$16,144,351	$7,594,097	$5,440,131
Scenario 4: Current Conditions	$426,012	$4,670,566	$16,925,444	$16,725,108	$12,239,254
Scenario 4: Accelerated Growth	$404,711	$4,437,038	$16,079,171	$15,888,852	$11,627,291
Scenario 4: Recessionary Decline	$447,313	$4,904,094	$17,771,716	$17,561,363	$12,851,217

The second component of the benefits side is time-savings on congestion and the associated potential economic development. In addressing this component, we used an Arellano-Bond regression across states.[6] The model correlates the year-over-year change in employment by state as a function of the previous year's year-over-year change in employment, the year-over-year change in hours of congestion, and the level of hours in congestion. A results summary is given in Table 7.

On the net, the results indicate that higher levels of congestion generally correlate with lower employment growth. In this analysis, this is taken to mean that expanding highway construction (i.e. lowering the hours of congestion) equates to stronger economic growth.

[5] See Choullarakis, Gwiazdowski, and Lazaretou (2013) and Batini, Nicoletta, Callegari, and Melina (2012) as examples.

[6] As compared to static models, the Arellano-Bond regression controls for previous values of the dependent variable, which in this case is the year-over-year change in employment.

The results in Table 7 were then converted into jobs and subsequently into revenue to the State when performing the NPV analysis.[7]

Table 7 - Arellano-Bond Regression Result

Arellano-Bond Dynamic Estimation

N=2431; Wald chi-squared(3)=1752.14

Dependent Variable: Y/Y Change in Employment	Data Source	Coefficient	z
Y/Y Change in Employment$_{t-1}$	LFA calc. based on Bureau of Labor Statistics	0.4652604	30.66
Y/Y Change in Hours in Congestion	LFA calc. based on Texas Transportation Institute	0.1206815	15.59
Hours in Congestion	Texas Transportation Institute	-0.0000068	-2.45
Constant		0.4654643	3.18

The results in Table 7 indicate that congestion savings may equate to actual economic development. To get at how much economic development could be generated by reducing congestion, we used the congestion hours estimated by UDOT in consultation with the Wasatch Front Regional Council. These are shown in Table 8.

Overall, the highest congestion-reducing project is the I-15 southbound SR-201 to 12300 south project, representing 5,197 hours of delay on a typical business day.

Table 8 - Congestion Savings by Project

Corridor Improvements		
Project	**Total Delay Savings with Project (Hr)**	**Total Daily User Cost**
Lehi Technology Corridor Study	1,415	$ 37,752.20
I-15 SB from SR-201 to 12300 South	5,197	$ 138,655.96
Express Lane from Hill Field Rd to I-84	1,509	$ 40,260.12

Spot Improvements		
Project	**Total Delay Savings with Project (Hr)**	**Total Daily User Cost**
7200 South	60	$ 1,740.39
Ashton Blvd/SR-92	40	$ 966.52

[7] On the results presented in Table 7: The *N* represents the number of observations. The *Wald chi-squared(3)* represents one measure of model fit (i.e. how well the model explains movements in year-over-year employment growth). The second column from the right, titled "Coefficient," is the correlation coefficient between the given predictor variable and the dependent variable (i.e. the coefficient measures the correlation between year-over-year growth in employment and hours commuters spent in congestion). When the coefficient is negative, it means that when say hours in congestion goes up, year-over-year employment growth generally goes down. The far right column is the z-value, representing a measure of statistical significance. When the z-value is above about 2, it means that the direction of the estimated coefficient is right 95 percent of the time.

Summary of Assumptions

Most of the major assumptions behind the analysis have now been given. This subsection provides a summary of all assumptions used in this analysis, followed by a brief explanation.

1. The discount rate is assumed at the expected true interest rate provided by Zions Public Finance, Inc. (1.527 percent for the 10-year and 1.913 percent for the 15-year).

   In NPV analyses, one is discounting future benefits to see whether the future benefits will be more than enough to offset the early-year costs of a given project. Because the dollar benefits are worth less years down the road than they are today, one needs to account for this timing discount. Because investors are willing to lend money to the State at true interest rates this seems to be a fair representation of investors' inflation expectations over the coming years. This assumption is corroborated when looking at the most popular discount rate, the 10-year note, which as of writing was yielding 1.39 percent.

2. Interest costs and bond payments as provided by Zions Public Finance, Inc.

   Zions Public Finance, Inc. provided the assumed payment structures of the bond payments. Depending upon how the market is when bonds are actually offered, different payment structures may be more advantageous at the time.

3. Time savings is estimated using the Wasatch Front Regional Council model.

   UDOT and LFA used the Wasatch Front Regional Council's transportation model to estimate congestion at the project locations. The derived hours spent in congestion stems from this (Table 8).

4. Economic benefits from the pushed-forward construction are estimated using Regional Economic Models, Inc. (REMI).

   REMI is a dynamic economic impact multiplier system. It takes user input (changes to the system) and estimates industry and economy-wide effects. The multiplier behind the "Highway Construction" industry variable was used in this analysis.

5. The REMI results are used as alternative forecast model assumptions in Forecast Pro.

   REMI does not directly estimate revenue to the General Fund or Education Fund. Instead, the REMI model produces such economic indicators as employment and personal income. It is these two figures that were used as alternative inputs into a forecasting model for revenue to the General Fund and Education Fund (Table 6).

6. Population growth of 1.75 percent.

   Zions Public Finance, Inc. used population growth of 1.75 percent to develop their bonding scenarios. This is similar to the 1.7 percent the State's Revenue Assumptions Working Group (RAWG) is using. To be consistent, we employed the same assumption as Zions Public Finance, Inc. The population figure matters in that it affects not only Zions' bonding calculations, but also the time savings from the freeing-up congestion calculation.

7. Wage appreciation of 3.25 percent.

   As with population growth, we employed the same wage growth assumption as Zions Public Finance, Inc. The 3.25 percent is also similar to the 3.1 percent the RAWG is using for 2017. The wage appreciation figure matters in that it affects not only Zions' bonding calculations, but also the time savings from the freeing-up congestion calculation.

8. Five percent stronger construction multiplier in recession scenario.

   Estimates of how economic multipliers change across the business cycle vary, but generally find that government spending multipliers are stronger during a recession than during a boom. We used a five percent stronger highway construction multiplier in the recession scenarios.

9. Five percent weaker construction multiplier in acceleration scenario.

   As just stated, the recession multiplier is assumed to be five percent stronger than the baseline scenario. Because multipliers are generally weaker during booms, we employed a five percent discount on the highway construction multiplier in the economic boom scenarios.

10. Fifteen percent interest expense increase in acceleration scenario.

    Interest rates are at historical lows, implying that if economic growth quickly accelerates, bond yields will likely follow suit. We employed a 15 percent interest expense increase in the economic boom scenarios.

11. Five percent interest expense savings in recession scenario.

    Because interest rates are already quite low, it is difficult to see them going much lower. Thus, and acknowledging the asymmetry with the acceleration scenarios, we used a five percent discount on interest costs in the recession scenarios.

12. Time savings relative to the current baseline does not decay over time.

    We assumed that, if bonding occurs, that projects are pushed forward for only one to three years (depending on the scenario), and does not affect other future projects outside of required interest payments in the out years. The interest payments in the out years may reduce available revenue for other projects (opportunity cost).

13. The estimated employment effect from congestion savings was estimated using an Arellano-Bond econometric model using data from the Texas Transportation Institute, the Bureau of Labor Statistics, and Moody's.

    As shown previously, we employed modeling to estimate the economic development effects from reduced congestion (Table 7).

RESULTS AND CONCLUSIONS

The results of the analysis are given in Table 9. Table 9 is similar to Table 1 with the addition of the "Nominal Interest and Cost of Issuance" column. This column (second column from the left) represents the actual dollars paid for issuing the debt and paying back the debt service. The column "PV Cost" converts the interest and issuance costs into real dollars. The column "PV Benefits" is the real present value of the benefits of the accelerated construction.

The left-hand side of Table 9 is the 10-year bonding scenarios and the right-hand side is the 15-year bonding scenarios (10-year bonding scenarios were analyzed with 10-year net present value time-horizons; 15-year bonding scenarios were analyzed with 15-year net present value time-horizons).

Overall, in each of the scenarios, the costs of interest and issuance outweigh the benefits, as illustrated by the negative numbers in the Net columns in both matrices.

Table 9 - Results Matrices for the 10-Year and 15-Year Bonding Scenarios

Results Matrix, 10-Year Bonding Scenarios					Results Matrix, 15-Year Bonding Scenarios				
Current Conditions					**Current Conditions**				
	Nominal Interest and Cost of Issuance	PV Cost	PV Benefits	Net		Nominal Interest and Cost of Issuance	PV Cost	PV Benefits	Net
Scenario 1	($115,510,500)	($97,996,636)	$30,522,324	($67,474,312)	Scenario 1	($140,695,600)	($120,908,372)	$30,638,703	($90,269,669)
Scenario 2	($124,719,250)	($106,064,915)	$51,580,344	($54,484,572)	Scenario 2	($151,807,700)	($130,635,767)	$51,390,613	($79,245,154)
Scenario 3	($164,414,000)	($139,304,112)	$65,680,867	($73,623,245)	Scenario 3	($200,361,250)	($172,070,349)	$65,452,816	($106,617,533)
Scenario 4	($263,652,250)	($215,243,625)	$102,822,063	($112,421,563)	Scenario 4	($315,818,250)	($266,637,241)	$102,420,878	($164,216,363)
Accelerated Growth					**Accelerated Growth**				
	Nominal Interest and Cost of Issuance	PV Cost	PV Benefits	Net		Nominal Interest and Cost of Issuance	PV Cost	PV Benefits	Net
Scenario 1	($132,837,075)	($112,696,131)	$29,259,836	($83,436,296)	Scenario 1	($161,799,940)	($139,044,628)	$29,365,922	($109,678,706)
Scenario 2	($143,427,138)	($121,974,653)	$50,217,456	($71,757,197)	Scenario 2	($174,578,855)	($150,231,132)	$50,016,573	($100,214,559)
Scenario 3	($189,076,100)	($160,199,728)	$63,886,365	($96,313,364)	Scenario 3	($230,415,438)	($197,880,901)	$63,644,437	($134,236,464)
Scenario 4	($303,200,088)	($247,530,169)	$99,962,099	($147,568,071)	Scenario 4	($363,190,988)	($306,632,827)	$99,542,259	($207,090,568)
Recessionary Decline					**Recessionary Decline**				
	Nominal Interest and Cost of Issuance	PV Cost	PV Benefits	Net		Nominal Interest and Cost of Issuance	PV Cost	PV Benefits	Net
Scenario 1	($109,734,975)	($93,096,804)	$31,784,813	($61,311,991)	Scenario 1	($133,660,820)	($114,862,954)	$31,911,485	($82,951,469)
Scenario 2	($118,483,288)	($100,761,670)	$52,943,231	($47,818,438)	Scenario 2	($144,217,315)	($124,103,979)	$52,764,654	($71,339,325)
Scenario 3	($156,193,300)	($132,338,906)	$67,475,369	($64,863,537)	Scenario 3	($190,343,188)	($163,466,831)	$67,261,195	($96,205,637)
Scenario 4	($250,469,638)	($204,481,444)	$105,682,027	($98,799,417)	Scenario 4	($300,027,338)	($253,305,379)	$105,299,496	($148,005,883)