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Memo

TO: Transportation Program Investment Committee
FROM: John Wilson, Economic Policy Analyst
DATE: October 20, 2016
SUBJECT: Construction Inflation Projections for SFY 2018 - 2027

Please find attached an annual update of recommended Construction Cost Index (CCI) inflation rates covering the upcoming 10-year Work Plan, including the STIP (2018 - 2021) and accompanying 6-year planning period ending in 2027. Communication of inflation factors to District estimators will follow TPIC consideration and resolution on approved levels.

I'd be happy to answer any questions on this analysis and welcome suggestions for future inflation forecasts.

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Construction Inflation Projections for SFY 2018 - 2027

based on recent trends and available forecasting through September 2016

Recommended Action: Approve inflation projections of the Construction Cost Index (CCI) for individual SFYs of 2018 - 2021 STIP and the six-year planning period which follows (2022 - 2027) in aggregate. See shaded Forecast rows of the table below—recommendations appear with **bold highlight** in the rightmost column.

Recent Context & Projection Rationale

- SFY 2016 CCI deflation of 8% stands as the steepest year-over-year decline recorded at least since 2000—and possibly ever (CCI has been compiled for 40 years)—thanks mainly to plummeting bituminous surfacing costs. The magnitude of the deflation would have been even greater except for a surprise increase in roadway excavation.
- The recommendation is derived from a bottom-up analysis of the individual CCI components, described below, and weighted according to the CCI methodology to arrive at a composite annual inflation rate. The results of this bottom-up approach can be considered alongside a benchmark price index for state and local construction spending. Historically, this independent national index has tracked MnDOT’s CCI within a precision of a percentage point when averaged over multiyear periods.

CCI Inflation History & Projections

	SFY	Change in Price Index for State & Local Construction Spending (Benchmark) ¹	Actual CCI Inflation ²	Oct. 2015 STIP+6 Guidance	Oct. 2016 STIP+6 Recommendation
ACTUAL	2000 – 2011	+5%	+5%	-	-
	2012	+4%	+12%	-	-
	2013	+3%	(4%)	-	-
	2014	+2%	+12%	-	-
	2015	+2%	+7%	-	-
	2016	+1%	(8%)	(11%)	-
	2012 – 2016	+2%	+3%	-	-
FORECAST	2017	+2%	-	+6%	(2%)
	2018	+3%	-	+4%	+7%
	2019	+3%	-	+4%	+7%
	2020	+3%	-	+4%	+6%
	2021	+3%	-	+4%	+5%
	2018 – 2021	+3%	-	+4%	+6%
	2022 – 2027	+2%	-	+4%	+3%
	2018 – 2027	+2%	-	+4%	+4%

¹ IHS Markit (history from U.S. Department of Commerce, Bureau of Economic Analysis), index = JPGLGIS

² MnDOT, Office of Project Management & Technical Support

Backdrop & High-Level Notes on Inflation

1. The trajectories for emergence from recessionary conditions earlier in the decade continue to diverge by type of construction. Calendar year to August, Dodge Data & Analytics calculates the value of construction starts nationwide has fallen 7% over the same period in 2015, with the nonbuilding sector (of which highway and bridge construction starts made up a bit over 50% in 2015) dropping most sharply, down 17%. The residential construction recovery has plateaued, posting 3% growth, while the non-residential building segment has contracted 10%.³
2. A statement from the July 26-27th Federal Open Market Committee summarizes the Federal Reserve's current, stable reading of background inflationary trends,

*The staff's forecast for consumer price inflation over the second half of 2016 was a little lower than in the previous projection, as recent declines in crude oil prices were expected to hold down consumer energy prices. Thereafter, the forecast for inflation was essentially unrevised. The staff continued to project that inflation would increase over the next several years, as energy prices and the prices of non-energy imports were expected to begin steadily rising this year and as resource utilization was expected to tighten further. However, inflation was still projected to be slightly below the Committee's longer-run objective of 2 percent in 2018.*⁴

3. Close correlations have either been confirmed (items a-c, below) or are hypothesized (newly-introduced series, items d-f) between MnDOT's CCI and several other national construction inflation indexes. The last reference (item g) is shown as a broad, local indicator—but one that has not behaved like CCI in the past. Performance in these tracking indexes suggested values for MnDOT's measure in SFY 2016 of:
 - a. National Highway Construction Cost Index (FHWA), +4%
 - b. Non-Manufacturing Prices Index (Institute for Supply Management), +0%
 - c. Goods Inputs to (All) New Construction Producer Price Index (PPI) (Bureau of Labor Statistics [BLS]), (14%) (deflation)
 - d. Construction for Government PPI (BLS), +2%
 - e. Goods Inputs to New (Highway, Other Heavy) Construction PPI (BLS), (5%)
 - f. Goods and Services Inputs to Highways and Streets PPI (BLS), (2%)
 - g. *Engineering News-Record* City Construction Cost Index for Minneapolis, +2%
4. Congressional passage of the Fixing America's Surface Transportation (FAST) Act in December 2015 ensures stable federal funding levels through FFY 2020, contingent on their implementation in annual appropriations bills. The authorization schedule includes a nominal inflationary adjustment of approximately +2% each year that is not expected to keep pace with highway construction cost escalation.
5. Through the second half of SFY 2018, the latest reading of nationwide transportation construction industry sentiment is fairly bright (rated a 63, with 50 defined as stable prospects and a value greater than 50 indicating confidence in current/anticipated growth), though on the decline after initially

³ Press release, Sept. 22, <http://www.construction.com/about-us/press/August-Construction-Starts-Jump-21-Percent.asp>

⁴ <https://www.federalreserve.gov/monetarypolicy/files/fomcminutes20160727.pdf#Page=7>

rallying with the FAST Act's signature. Transportation now outperforms the all-sector construction average (58) as well as the U.S. economy itself (53).⁵

6. The national unemployment rate (not seasonally adjusted) published by BLS for those who last worked in construction was 5.2% in May 2016—a major improvement from the mark of 20.1% recorded for May 2010. The construction labor market in Minnesota is even tighter, as estimated by Associated Builders and Contractors, with an unemployment rate of 2.1% as of May 2016, the 3rd lowest in the nation and a level not seen in 15 years.⁶ A summer survey conducted by the Associated General Contractors of America also rated craftworker hiring difficulties to be most extreme in the Midwest, although labor shortages eased from 2015.⁷

Bituminous Surfacing

1. Bituminous surfacing makes up 43% of the CCI, with fixed dollar weights established in the base year of 1987, and this share rose to 49% in SFY 2016.
2. MnDOT's inflation for asphalt separated—highly favorably—from the corresponding PPI after two years of nearly identical year-over-year performance by the two indicators. In SFY 2016, MnDOT's figure of (18%) dwarfed the PPI change of (5%). Adding further context, since 2000, the largest one-year drop previously logged within MnDOT was (4%).
3. No direct forecast of asphalt pricing available to the public has been discovered. (IHS Markit coverage can be obtained for a separate subscription fee but is only irregularly quoted in the *Engineering News-Record*.)
4. Indirectly, the prices for asphalt and oil products are expected—and were proven—to move together for two reasons:
 - a. asphalt binder (refined bitumen) is derived from distillation of crude oil or recovered from naturally-occurring (e.g. Canadian oil sands) deposits
 - b. fuel represents a sizable fraction of the delivered price for asphalt
5. Given both the manufacture and transport explanatory effects, asphalt inflation is modeled as a function of the crude oil forecast (Brent benchmark). Additional analysis by Parsons Brinckerhoff has identified overall domestic macroeconomic output (expressed by real gross domestic product) as a second important independent variable.
6. Brent crude oil spot prices plunged over 40% in SFY 2016, deepening SFY 2015's 33% freefall. Though clearly supportive of restrained price increases for finished products like asphalt, raw commodity economics do not typically translate proportionately downstream. An annual Energy Information Administration (EIA) survey⁸ showed that total national atmospheric crude oil distillation capacity, a common measure of refinery size, stood at 18.3 million barrels per calendar day as of January 2016, only modestly (1.9%) higher than the prior reading and helped by the startup of two Texas refineries. Closer to home, the St. Paul Park Refining Company expects to complete a minor expansion by the end of 2016.

⁵ *Engineering News-Record* article, Oct. 10, p. 39 (behind subscription paywall)

⁶ *Star Tribune* article, June 28, <http://tinyurl.com/gwqmcep>

⁷ *Engineering News-Record* article, Oct. 10, p. 36 (behind subscription paywall)

⁸ *Energy Information Administration* "This Week in Petroleum" article, June 29, <http://tinyurl.com/jffdnhd>

7. Despite renewed VMT growth, worldwide stockpiles of motor fuels—now tilted toward gasoline after a few years that favored diesel given relatively strong emerging market conditions—are well above five-year average reference bands, weighing on refiner profitability.
8. The bituminous inflation forecast tied to GDP growth and crude pricing rises quickly through the first half of the STIP, projecting to crest at +10% in 2019, before subsiding to a level of 4% for much of the 2020s.

Structural Concrete & Concrete Surfacing

1. All concrete applications constitute 31% of the CCI, split roughly $\frac{1}{3}$ pavement, $\frac{2}{3}$ structures. By contrast, concrete in SFY 2016 captured a 42% dollar-share of all surfacing work (up from 28% the prior year), and concrete paving alone formed 36% of the SFY 2016 budget. Structural concrete contributed another 5% of last year's program.
2. Both surfacing and structural concrete inflation retreated in SFY 2016, correcting after 2015's double-digit inflation stemming from project specifics rather than commodity fundamentals. Pavement unit costs fell only slightly [(2%)]—possibly reflecting continued pricing power among contractors collectively operating close to industry capacity. On a much lower base of business, structural concrete deflated at the fastest rate since 2002, (14%). MnDOT's experience last year ran counter to the moderately positive inflation published for the national ready-mix concrete PPI as well as the Midwest regional ready-mix sub-PPI [both +4%], although the two-year net change for structural concrete works out the same for MnDOT and PPI data.
3. After a sustained concrete paving program in SFY 2016, project counts and volumes are due to drop sharply in 2017 and 2018. Therefore, a resumption of the long-term average inflation rate for concrete surfacing is proposed beginning in 2017, with year-to-year variability based on diesel (delivery) prices.
4. Structural concrete will continue to be handled separately through a regression relationship formulated by Parsons Brinckerhoff that weights component pricing changes in cement (primary) and rebar (secondary).

Roadway Excavation

1. Excavation contributes 14% to the CCI and dipped to 8% in SFY 2016.
2. An inflation spike in SFY 2016 saw roadway excavation costs increase 43% over the prior year. This volatility may be attributable to some extent to 2016's relatively small total excavation volume—roughly $\frac{1}{3}$ the 2015 haulage (2.1 million C.Y. vs. 5.9 million C.Y. previously). The category price movement more than offsets the favorability in all other CCI components except bituminous surfacing, as illustrated in the waterfall chart at the top of Page 9.
3. Considering Midwest diesel prices tumbled 28% last year, pure per-mile transport costs were a powerful countervailing factor, meaning the project portfolio overwhelmingly determined the inflation outcome.
4. A three-dimensional graph of project-level results (see Page 10 below)—summarizing project size, letting date, and derived unit cost—seeks explanatory influences for this rolled-up result but fails to isolate any overriding cause for the unexpectedly severe inflation. It is challenging to pinpoint a handful of outliers that dictated the average, although projects let between November 2015 and February 2016 tended to have elevated unit costs.

5. A relatively simple—though certainly imperfect—approach to account for the urban/rural split of excavation sites is to count and assign a unit cost premium to those projects scheduled in counties classified as “metro areas” by the U.S. Census Bureau (as of July 2015).⁹ The metro subset, numbering 27 (31%) counties, will not always correspond with project location, but can be thought of as a way of “playing the percentages.” This is a tractable option for the STIP years since a project’s county can be instantly determined from the first two numbers of its SP designation.
6. Following this method on the SFY 2016 portfolio—by color-coding metro counties red and rural counties yellow—is instructive. Of the five rural county projects, three came in with unit costs below even SFY 2015’s average (none of the metro county projects did so), and one other was below the SFY 2016 mark. Additionally, on the two letting dates with jobs from both geographies, the rural project ranked as the lowest-cost in both cases. This is in line with estimates by the Office of Program Management and Technical Support that projects navigating constrained urban environments may run unit costs 50% higher than similarly-sized rural work.
7. The share of earthwork quantity associated with metro counties also climbed 16 percentage points from SFY 2015 to 2016, and 2016’s 71% metro statistic was the highest since 2011—a year when roadway excavation inflation similarly soared more than 40%.
8. Rerunning the experimental regression last attempted after SFY 2014, bringing together these three promising factors—(a) diesel price, (b) the proportion of roadway excavation projects occurring within metro counties, and (c) total earthwork quantity—to explain average roadway excavation cost changes... unfortunately still doesn’t yet turn up a stable and intuitive relationship to serve as the foundation for future forecasting.
9. Excavation inflation has jumped by at least 25% four other times since 2000 (in SFYs 2002, 2005, 2011, and 2014). In each of those cases, inflation in the following year subsided or even reversed course, dropping into negative territory. As a case in point, roadway excavation costs retreated 17% in SFY 2015.
10. Consequently, a similar resumption of the long-run mean is currently forecast for the STIP+6, following an immediate, one-year correction drawn from the average of the four earlier post-25%+ episodes.
11. A general correlation has emerged between unit excavation costs and diesel prices, and this connection will be the basis for ongoing forecasting while it holds. Remaining variation in the excavation inflation rate from year to year is explained by differences in the material being excavated, removal location, replacement/embankment specifications, staging, movement efficiency (i.e. how many times the excavated material is “touched”), and other project specifics that are likely not finalized for construction scheduled many years from now.

Reinforcing & Structural Steel

1. Steel’s CCI share of 11% dwindled to just 2% for last year’s projects for the second year running. Also continuing from SFY 2015, there were no eligible, representative jobs employing structural steel last year, leading it to be ignored when figuring year-over-year comparisons of the composite index.
2. Volatility in steel prices is demonstrated by the double-digit inflation rates—positive or negative, for at least one of the steel subindexes—recorded in 13 of the 17 fiscal years since 2000, including for SFY 2016 when the structural steel PPI sank 15%.

⁹ http://www2.census.gov/geo/maps/metroarea/us_wall/Jul2015/cbsa_us_0715.pdf

3. Confronted with both low-priced imports and dwindling demand from many energy sector customers, the domestic steel industry registered an operating efficiency of 61%¹⁰ at the end of 2015, substantially below healthy production levels at 70+% of capacity.
4. In a fundamental retooling of its slowing economy, China has withdrawn approximately 100 million metric tons of unnecessary steel production capacity since 2010—more than the entire volume manufactured in the U.S. in 2015 of 87 million tons—and aims to retire an additional 100 million tons by the early 2020s. Consolidation talks made public in June that could lead to the creation of the world’s second-largest steelmaker highlight this restructuring push, though the extent of realized capacity cuts remains to be seen.¹¹
5. At the same time, China seeks to capitalize on export markets modeled on age-old Silk Road trading to encourage infrastructure development making use of still-abundant Chinese steel in as many as 65 prospective partner countries.¹²
6. Steel costs continue to be modeled over the STIP+6 time frame as tracking with the IHS Markit inflation factor for metals and metal products, anchored to the long-term average inflation rates historically experienced by MnDOT for reinforcing and structural steel. Structural also incorporates a GDP term, as recommended by the PB study cited above in the bituminous surfacing section.

Uncertainty

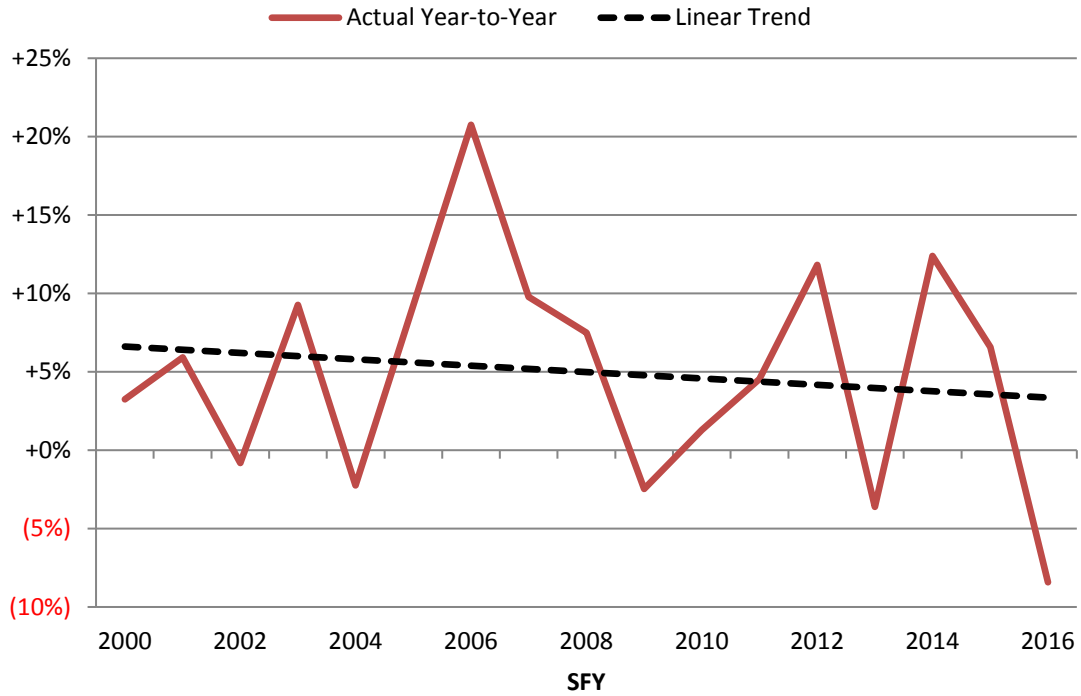
- Price jumps, and eventual drops during reversion to the long-term trend, are inherently difficult to anticipate years in advance. Continual, year-round monitoring of underlying market forces and recorded prices will be performed to detect sizable departures from forecast.

¹⁰ *Houston Chronicle* article, Dec. 30, <http://tinyurl.com/hlj3n4e>

¹¹ Bloomberg article, June 27, <http://bloom.bg/29gl7ag>

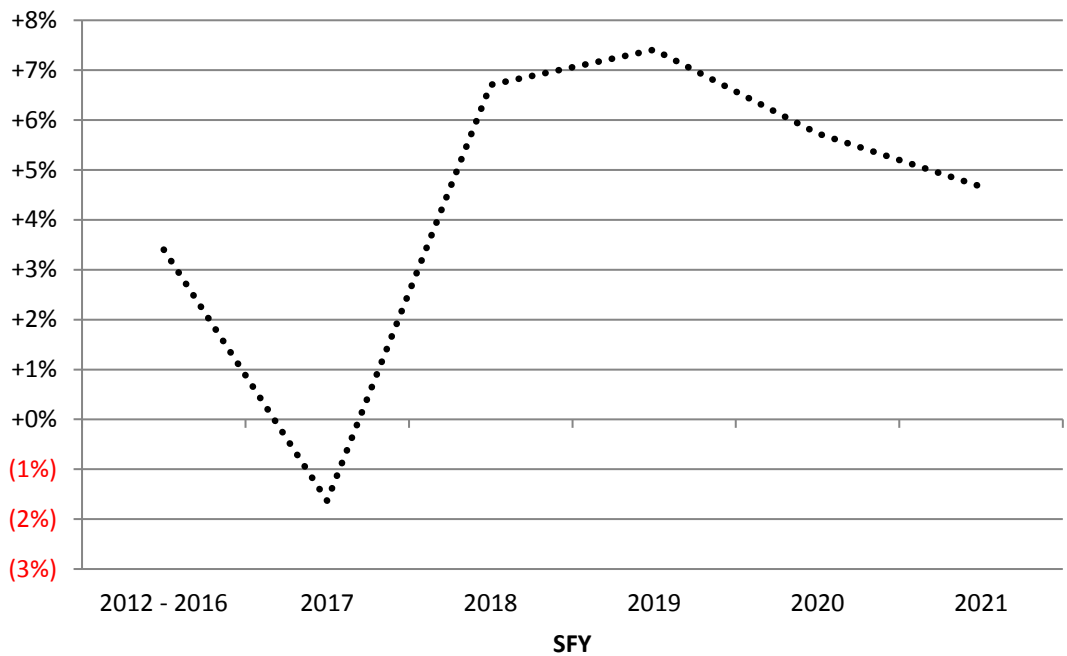
¹² *S&P Global Platts Insight 2016 Global Metals Trends* article, May, <http://tinyurl.com/jye5gsg>

CCI Inflation History & Regression Trend

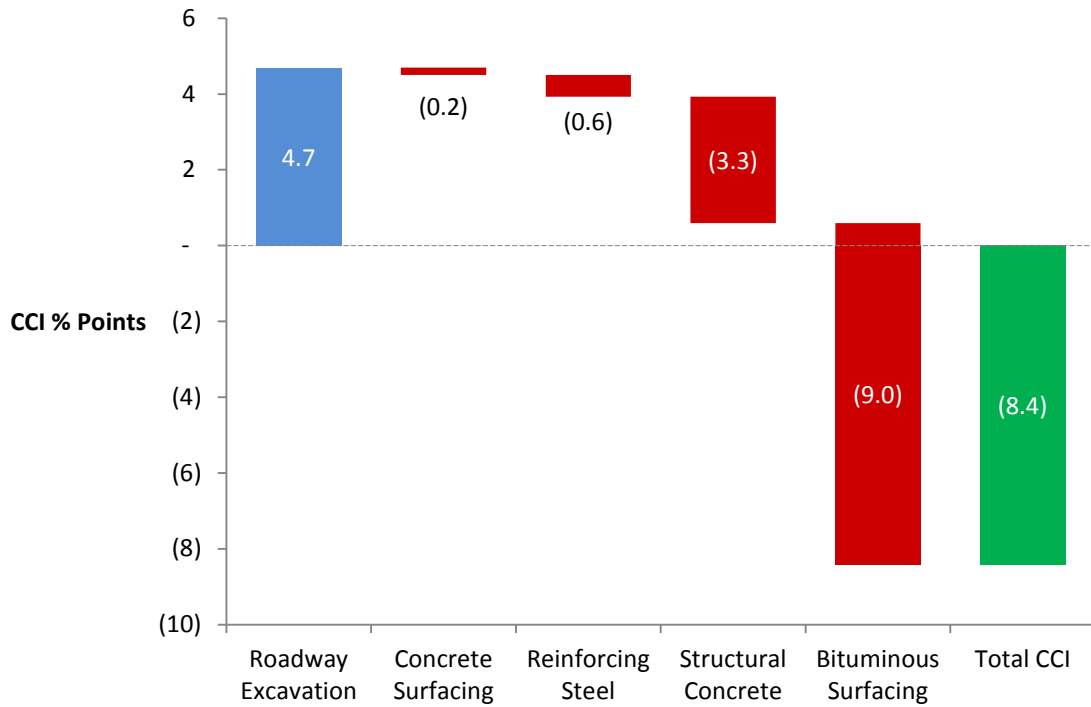


CCI Inflation STIP Projection

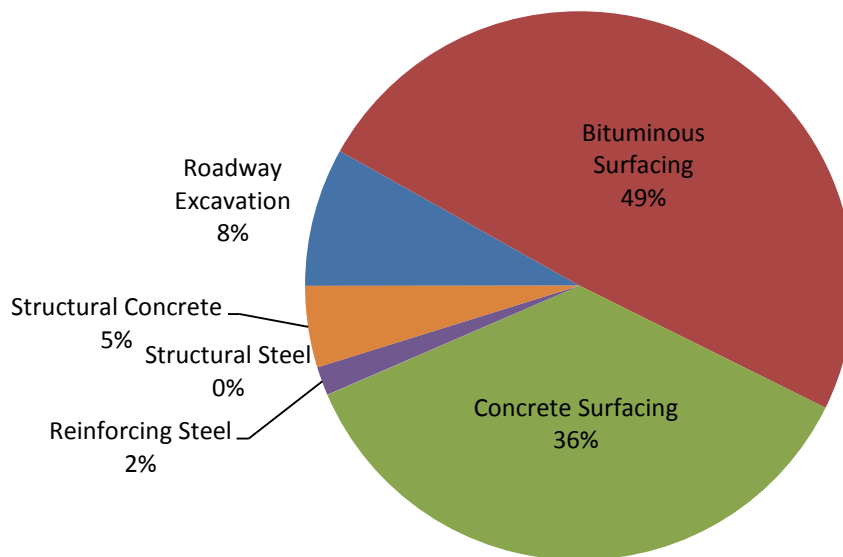
October 2016 outlook



Waterfall Breakdown of 2016 8% Deflation



SFY 2016 Program Dollar Distribution



ROADWAY EXCAVATION Statewide Project Unit Cost Profile: SFY 2016

size of bubble indicates project size/volume (earthwork quantity); selected highways labeled

