U.S. TRANSPORTATION CONSTRUCTION MARKET FORECAST 2017

National Summary | 5-Year Modal Forecast

American Road & Transportation Builders Association
This report was prepared for the American Road & Transportation Builders Association Transportation Development Foundation (ARTBA-TDF) by a team led by ARTBA Chief Economist Dr. Alison Premo Black. The ARTBA team included Lital Shair Nada and Carolyn Kramer, who did primary research and content development—with assistance on regulatory issues from Dean Franks, Nick Goldstein and Brad Sant. Sammy Monaghan designed the publication. The Foundation was established in 1985 as a 501(c)3 tax-exempt entity to support research, education and public awareness programs relating to transportation development in the United States.

The Foundation supports a wide array of programs and activities including: the National Work Zone Safety Information Clearinghouse; the Federal Highway Administration Local & Tribal Technical Assistance Program Clearinghouse; the Safety Certification for Transportation Project Professionals Program™; the Lanford Family Highway Worker Memorial Scholarship Program; the Dr. J. Don Brock TransOvation™ Workshop and Awards Program, the Transportation Builder Institute, the permanent transportation exhibition at the Smithsonian's National Museum of American History, and annual awards programs recognizing best practices, innovation, safety community service and environmental stewardship.

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Cover Image: Photo Courtesy of STV. Project Location: Boston, Massachusetts. Photographer: Mark Flannery
EXECUTIVE SUMMARY

Total transportation construction and related market activity is expected to grow 1.3 percent in 2017, driven largely by increases in highway and bridge private construction activity supporting residential and commercial developments, according to ARTBA’s forecast model.

In 2017, the market is expected to reach $247.8 billion, up from $244.5 billion in 2016. This includes public and private investment for highways, bridges, public transit, rail, ports and waterways, airport runways and terminals, as well as private investment for roads, streets, driveways and parking lots in residential and commercial developments and support work by state departments of transportation (DOTs) and local governments for highway and bridge planning and design work, routine maintenance and right of way purchases.

Although the December 2015 enactment of the federal “Fixing America’s Surface Transportation Act” (FAST Act) law provided stability for public highway investment, the increases that will be realized in the federal program funding levels are modest, just above anticipated growth in inflation and project costs.

Many state DOTs did not obligate their federal funds in time for many projects to get started during the 2016 construction season. Nearly half of the FAST Act funds for FY 2016 — 46 percent — were obligated in the last quarter of the federal fiscal year, between July and September 2016. Twenty percent of the federal funds available to the states were not obligated until September 2016.

Also of note and a factor in the ARTBA forecast, in early December Congress is expected to pass a “continuing resolution” that would hold all FY 2017 federal discretionary spending—including the transportation programs—at the current level until March 31, 2017. Under this approach, the $900 million increase in highway investment authorized by the FAST Act and included in the House and Senate FY 2017 transportation funding bills would be delayed at least until next spring. Similarly, the $510 million to $670 million public transportation funding increases in the House and Senate transportation measures would also be delayed. The existing funding levels for these and other programs would continue.

By infrastructure mode, forecast highlights include:

Public & Private Highway, Street & Related Construction
After two years of real growth, the value of public highway, street and related work by state DOTs and local governments fell nearly 2 percent in 2016 and is expected to decline another 1 percent in 2017, according to ARTBA’s forecast.

• Recent increases in state gas taxes and user fees, as well as a number of local funding initiatives approved on the Nov. 8, 2016 ballot, should help support some local markets over the next few years. Voters in 24 states approved 267 ballot measures in 2016, which will support $207 billion in highway, bridge, port and transit spending over the next 40 years.

• Overall, highway program contract awards are up in 15 states and Washington, D.C., compared to a three-year historical average, down in 25 states and within a five percent range up or down in 10 states.

• Public-private partnerships will continue to be important to state and local markets that have revenue streams to support these projects. Five major projects came to financial close in 2016, totaling over $3.3 billion in investment. The projects were in Arizona, Washington, Georgia, Texas and Virginia.

The ARTBA forecast also looked at private highway, bridge, parking lot and driveway data captured by the U.S. Census Bureau as part of its residential and commercial construction report. Based on historical data, ARTBA estimates the private market will increase from $58.9 billion in 2016 to $62.5 billion in 2017, and will continue to grow over the next five years as overall construction activity increases in those sectors.
**Bridges & Tunnels**

The public bridge and tunnel construction market is expected to be down slightly in 2017, to $32.9 billion from a record $33.3 billion in 2016, before resuming real growth in 2018 and beyond.

- Based on recent contract awards data, work is expected to be up in 19 states, down in 28 states and Washington, D.C. and fairly flat within an up/down range of 5 percent in four states.
- The national market is driven by activity in nine states, which accounts for 53 percent of the market: California, Florida, Illinois, New Jersey, New York, Pennsylvania, Texas, North Carolina and Ohio. Recent contract awards are down in many of these states, in part because of some major projects that got underway in 2015.
- The bridge market is expected to account for 37 percent of all highway and bridge construction activity, up from 20 percent in 2000.

**Railroad, Subway & Light Rail**

ARTBA’s forecast model is for public transit and rail construction to grow from $19.3 billion in 2016 to $20.3 billion in 2017, an increase of 5 percent.

- After a decline of nearly 10 percent in 2016, investment by private Class 1 freight railroads is expected to grow 6.4 percent to $12.7 billion.
- Subway and light rail investment is expected to grow 3.7 percent to $7.7 billion, just below the record level of $7.8 billion in work that was set in 2015.
- Recent growth in rail freight shipments slowed in 2016, in part because of the decline in crude oil production and shipments. A number of freight railroad companies pulled back slightly on capital investments in 2016, but significant demand exists with the focus on intermodal shipments, airport-rail connections and the completion of the Panama Canal expansion.
- The FAST Act provided a boost for public transportation investment. In addition to a dozen major subway and light rail projects underway, there were four new construction starts in 2016, including work in Washington state, Washington, D.C., Texas and California.
- On Nov. 8, 2016, voters approved $61.3 billion in transit projects, plus an additional $139 billion for programs that would include highway, bridge and transit spending.

**Ports & Waterways**

The value of port and waterway investment is expected to be $2.1 billion in 2017. Construction activity in 2016 was also $2.1 billion, down from $2.3 billion in 2015.

- If Congress completes final action in 2016 on the Water Resources Development Act (WRDA), which identifies nearly $9 billion in navigation, flood control and environmental restoration projects that are eligible for Congress to fund, it could help boost the market sector. In its current form, the bill would authorize dredging projects in eight ports to deepen navigation channels.
- Some states that have increased investments in recent years include Louisiana, Florida, New York, Texas and Washington. Major projects are also expected to be underway in 2017 at major ports in Massachusetts, California, Florida and Georgia.
- The expanded Panama Canal began commercial operation on June 26, 2016. There are four East Coast ports that can handle the new mega-ships passing through the Canal.

**Methodology**

The ARTBA forecast is based on a series of proprietary econometric models for each mode and analysis of federal, state and local data and market intelligence. The ARTBA Economics & Research team, led by Dr. Alison Premo Black, has more than 40 years of combined experience analyzing the transportation construction market. ARTBA has conducted over 80 studies examining trends in national, state and local markets.
## 2017 ARTBA Forecast of Real Major Transportation Construction Market Activity (in billions 2016$)

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<th>2018 (f)</th>
<th>2019 (f)</th>
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<td>$267.2</td>
<td>$273.4</td>
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ARTBA 2017 forecast of real value of U.S. transportation construction market

Source: ARTBA forecast model. Measuring U.S. Census Bureau Value of Construction Put in Place for major modes, plus estimates of planning and design work, right of way and maintenance expenditures for state and local governments, and private driveway, parking lot and residential developments streets and bridges. Nominal values adjusted with ARTBA Price Index.

Federal funds, on average, provide 51% of annual State DOT capital outlays for highway & bridge projects

Source: ARTBA analysis of FHWA Highway Statistics data, total ten year average 2005-2014 from tables SF-1 and SF-2. The percent is the ratio of federal aid reimbursements to the state and total state capital outlays and is indicative of the importance of the federal aid program to state capital spending for highways and bridges. Does not include local capital spending. Federal highway reimbursements are primarily used for capital outlays, including construction, right of way and engineering, but are also used for debt service for GARVEE bonds.

* States that have issued GARVEE bonds before 2014.
The construction market for highways, streets and related work and private driveways, residential streets and commercial parking lots is expected to increase to $151.2 billion in 2017 from $148.8 billion in 2016. This growth is being driven entirely by private work, which will increase in line with the expansion of residential and commercial construction.

Public highway, street and related investment by state and local governments is expected to decline slightly to $55.8 billion from $56.6 billion in 2016. The forecast range is between $55.1 and $56.5 billion. To put this figure in perspective, state and local governments completed $66.3 billion in highway work in 2009.

After a strong start in the first quarter of 2016, public highway and street spending fell over the summer months, with total construction activity ending the year at $56.6 billion, down from $57.6 billion in 2015. Thus, the pavement market recovery that began in 2013 has taken a pause, and absent significant new projects getting underway in early 2016, the national market is expected to continue to be flat in 2017. Although the FAST Act provides market stability for state DOTs, the modest funding increases are not enough to drive significant, real market growth across the country. Therefore, it is up to state and local governments to provide new resources to grow investment. A number of states have increased resources over the past few years, with 17 states alone raising their gas tax rates since 2013.

Despite these positive developments, most of these states continue to need additional resources to meet their transportation needs. In some cases, the increase in revenue is being split among different modes and agencies or is needed just to match federal funds. An increase in a state gas tax or revenue does not always mean a similar increase in construction activity. At a national level, growth in some state programs is being “offset” by cuts in other regions. For example, Texas and Florida are two states that have significantly increased investment over the last few years, yet California recently cut $1.5 billion in projects from their plan because of revenue shortfalls in early 2016.

Some additional factors that could impact the highway market in 2017 and beyond:

**Politics, Congress & the New Administration:**
During his presidential campaign, President-elect Donald Trump promised to make infrastructure a priority in his first 100 days. Although there are few specifics at this point, an increase in either the traditional program or a plan to leverage private investment could have a positive impact on the market in 2018 and beyond. An increase in the federal program levels, which by law are largely required for capital outlays, would boost construction activity in every state. Although these developments are not expected to impact the 2017 market, a permanent solution to the funding gap between revenues to the Highway Trust Fund and planned spending levels would be beneficial to the market. Absent action by Congress, the industry will be considering a return to the funding gap as the FAST Act expires in 2020.
Change in State DOT Obligations: Despite the stability of the FAST Act, state DOTs did not change the recent pattern in the pace of their obligations. A total of 46 percent of the FAST Act funds available to state DOTs were obligated in the last quarter of the federal fiscal year, July to September 2016. A total of 33 states actually obligated 20 percent or more of their funds in the last month possible, September 2016. This delay is similar to what state DOTs do during times of uncertainty over the federal aid program and prolonged reauthorization delays.

This means that these projects, as they are put out to bid by state DOTs and enter the construction phase, may provide a small boost to market activity in 2017. Overall, the FAST Act increased FY 2016 apportionments by $1.9 billion over FY 2016 levels. The majority of this amount—$1.1 billion—is for the new National Freight Program.

Project Costs & Material Prices: The average annual increase in project costs has averaged 1 percent since the Great Recession in 2008, according to the ARTBA Price Index, which takes into account general inflation, industry wages, material prices and other project costs. The historical average is 3.3 percent. As the general construction market recovers, increased demand for shared construction materials could begin to push project costs higher for highway and bridge construction. The Federal Reserve is forecasting general inflation in the coming years to be between 1.9 and 2.1 percent.

Focus on Bridge Work: In an era of limited resources, the focus by many state DOTs on bridge work over the last decade has meant less for pavement projects. As a share of the highway and bridge market, bridge work has increased from 19.6 percent of the total in 2000 to 37.4 percent in 2016. Historically, we have seen an increase in bridge market activity after the reauthorization of a federal bill as state DOTs, with more funding certainty, put federal dollars towards larger bridge projects. As states continue to work on large bridge projects and bridge programs, growth is expected to be modest in the pavement market.

Transportation Investment Generating Economic Recovery (TIGER) Grants: TIGER grants provide discretionary funds that the U.S. Secretary of Transportation awards for projects that have a significant impact on the nation, a region or a metropolitan area.

Of the $485 million in projects awarded in FY 2016, $190 million was awarded for 15 roadway and highway-related projects. Some major projects supported by TIGER grants include: a $262.4 million passenger rail project in San Bernardino County, California, to upgrade an existing rail corridor and make improvements to at-grade roadway crossings; a $237.0 million project to improve I-25 between Loveland and Fort Collins in Colorado; a $56.1 million
A $40.5 million roadway reconstruction project in Michigan. Overall, $62.8 million is going to rural development projects while the remaining $126.7 million is going to urban projects.

**Transportation Infrastructure Finance and Innovation Act (TIFIA):** The FAST Act decreased annual funding for TIFIA, which was created in 1998 to provide loans and loan guarantees to major transportation investment projects. The FAST Act cut annual investment for the TIFIA credit assistance program from the $1 billion per year authorized in FY 2014 and FY 2015 to $275 million in FY 2016 and FY 2017, $285 million in FY 2018, and $300 million in FY 2020.

While this reduction is likely the result of the FAST Act’s revenue constraints rather than opposition to the TIFIA Program, it should be noted the Federal Highway Administration (FHWA) was required to transfer $639 million in TIFIA funds to the highway formula programs on April 27, 2015, because TIFIA’s uncommitted balance exceeded the statutory limit Congress imposed as part of MAP-21. Moreover, the FAST Act eliminates that mandatory redistribution of uncommitted balances, ensuring all resources allocated to the TIFIA program are reserved only for that activity.

In FY 2016, the U.S. DOT received 10 letters of interest for projects totaling $10.7 billion. The U.S. DOT recently awarded several TIFIA loans, including $357 million to support the construction of the $1.1 billion State Highway 288 Toll Lanes public-private partnership (P3) project in Texas; $282 million to support the construction of the US-183S Bergstrom Expressway in central Texas; $211 million to support Delaware’s US 301 Project; and $200 million for the I-93 Improvements Salem to Manchester Project in New Hampshire. Loans can only be made for projects that can begin the letting process within 90 days, which means FY 2016 TIFIA loans should support market activity in the coming year.
Real value of public highway, street and related construction

Source: ARTBA forecast model. Measuring U.S. Census Bureau Value of Construction Put in Place for highways, streets and pavements. Nominal values have been deflated with the ARTBA Price Index, which takes into account material prices, project costs, general inflation and industry wages.

Real value of private highway, bridge, street and driveway construction

Source: ARTBA estimates based on forecast model. Private work includes residential streets, commercial parking lots, private roads and bridges. This data is part of the Census Bureau Value of Construction Put in Place series for residential and commercial construction. Nominal values have been deflated with the ARTBA Price Index, which takes into account material prices, project costs, general inflation and industry wages.
**Real value of state DOT & local government maintenance outlays for highways, streets & bridges**

Source: ARTBA estimates based on forecast model and FHWA data. Nominal values have been deflated with the ARTBA Price Index, which takes into account material prices, project costs, general inflation and industry wages.

**The Highway Trust Fund Revenue Crisis Will Return**

Source: Congressional Budget Office Highway Trust Fund baseline, January 2016
After reaching record levels in 2016, the bridge and tunnel construction market is expected to remain relatively flat before resuming growth over the next four years. The total value of work in 2017 will be $32.9 billion (within a range of $32.5 to $33.3 billion), down from $33.3 billion in 2016. The national market is driven by activity in nine states, which account for 53 percent of the market: California, Florida, Illinois, New Jersey, New York, Pennsylvania, Texas, North Carolina and Ohio. Recent contract awards are down in many of these states, in part because of some major projects that got underway in 2015.

Bridge and tunnel construction will continue increasing over the next five years due to overall economic growth, expected new starts, and a continued focus on bridge projects by state DOTs. Historically, the bridge market has shown real growth after a federal highway bill is enacted. Additional factors that could impact the national bridge market include:

**TIGER Grants:** In 2016 alone, U.S. DOT awarded 40 TIGER grants valued at $485 million, of which 18% were for bridge-related projects. These projects include the $22.0 million project to reconstruct or rehabilitate river crossings in Des Moines, Iowa, the $19.5 million Portland Marine Terminal Freight and Jobs Access Project in Oregon, the $18.0 million replacement of the Eighth Street Bridge over the White River in Anderson, Indiana, and $16.5 million for the Re-Connecting Cleveland project in Ohio. Work on these and other bridge-related projects will help support continued market activity as these projects are underway. There are also a number of multimodal freight rail and transit projects in the TIGER program that include bridge and tunnel work.

**TIFIA Program:** There are currently six bridge projects and 2 tunnel projects that have active credit agreements under the TIFIA program. These include the New NY Bridge Replacement of the New York Tappan Zee Bridge (a $5.0 billion project), the SR 520 Floating Bridge project ($2.7 billion) in Washington, the Downtown/Midtown Tunnel Project ($2.1 billion) in Virginia and the Downtown Crossing portion of the Ohio River Bridges project ($1.5 billion) in Kentucky. No other bridge projects have submitted a Letter of Interest for a TIFIA loan in FY 2016.

**Bridge Conditions:** The network of bridges across the United States is in serious need of repair. Over 20 percent of the nation's bridges are either structurally deficient or functionally obsolete. State DOTs and local governments will need to continue investing in the U.S. bridge network to make necessary safety and structural improvements. Several major bridge reconstruction or replacement projects are underway, including the $1.5 billion replacement of the Goethals Bridge between New York and New Jersey, the $235.7 million rehabilitation of the Verrazano-Narrows Bridge in New York City and the $1.2 billion replacement of the Gerald Desmond Bridge at the Port of Long Beach. Under the FAST Act, bridge repair projects will have a more streamlined environmental review process, by exempt-
ing “common post 1945 concrete or steel bridge[s] or culvert[s]” from individual review. The FAST Act loosens requirements under the Migratory Bird Treaty Act for repairs made to bridges in “serious” condition or worse.

Additionally, the FAST Act authorizes and encourages states to bundle multiple similar bridge projects into one project that can be awarded as a single contract to improve efficiency and expedite project delivery.

**Accelerated Bridge Construction:** In recent years, more states have been using accelerated bridge construction for bridge replacement projects. Accelerated bridge construction is the use of prefabricated components or other processes or technologies to significantly reduce the time spent constructing a bridge, from years to days. At least 15 states have a policy or directive in place that discusses the use of accelerated bridge construction on some sort of programmatic level, each with different criteria and priorities. Typically, states will prioritize projects in their State Transportation Improvement Program (STIP), then discuss the use of accelerated bridge construction during the project delivery phase. Pennsylvania and Massachusetts are both currently in the midst of accelerated bridge construction programs, where a grouping of bridge projects across each state are completed in an accelerated time frame. Once a state completes a project in as little time as over a weekend, there is public and political support for more projects using accelerated bridge construction. This type of bridge construction will likely be used more frequently in the coming years.

### Real value of bridge & tunnel construction

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<th>Value (in billions)</th>
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Source: ARTBA forecast model. Measuring U.S. Census Bureau Value of Construction Put in Place for public bridge and tunnel work. Nominal values have been deflated with the ARTBA Price Index, which takes into account material prices, project costs, general inflation and industry wages.
The national market for highway and bridge planning and design work is expected to be $13.4 billion in 2017, down slightly from $13.6 billion in 2016. Historically, planning and design outlays by state DOTs and local governments has averaged $1 for every $6.50 to $7.00 in public highway and bridge construction spending.

State DOTs and local governments are also expected to spend an additional $6.7 billion on right of way purchases.

For many states, consultants are handling an increasing portion of planning and design work.

**Design-Build Procurement Trends:** Design-build has been playing a larger role in some state markets, providing additional opportunities for outside consultants.

- Ohio actively uses design-build projects; two large upcoming projects are the $268.9 million CUY-480 bridge deck replacement project and the $235.7 million construction of section 3 of the Opportunity Corridor.
- Connecticut, Maryland, Minnesota and Vermont also have active design-build programs. Michigan regularly uses design-build on one to five projects per year, and Mississippi currently has 2 small bridge widening and preservation design-build projects in its program.
- Arkansas is developing its first design-build-finance project, a $631.7 million project to widen and reconstruct portions of Interstate 30 and Interstate 40 in Central Arkansas, and anticipates the continued use of design-build or design-build-finance across the state. Idaho passed legislation to allow design-build in 2010, and is currently pursuing one or two alternative contracting method projects per year, while looking at design-build as the primary process for delivering bridge replacement projects.
- Nevada, which has been employing design-build for projects for over 12 years, has 2 projects currently under construction: the $449 million Project NEON and the $75.9 million USA Parkway project.
- Texas is permitted to use design-build for up to three projects per year with a minimum project cost of $150 million, and in fiscal years 2016 and 2017 the minimum project cost will be raised to $250 million.
- Nevada, which has been employing design-build for projects for over 12 years, has 2 projects in the procurement phase: the $65-75 million USA Parkway project and phases 1 to 4 of Project NEON, which will cost about $400-500 million.
- Washington, D.C. has pursued several large projects using design-build, including the over $300 million Eleventh Street bridge project, the $55 million 9th Street bridge project, and the $23 million New York Avenue Bridge project. Pennsylvania uses design-build for about one quarter of its program.
- Washington state is anticipating an increased use of design-build delivery in the future, in the greater Puget Sound region as well as in Vancouver, Tri-cities and Spokane; following legislative authority to administer design-build contracts for projects in the $2 million to $10 million range, Washington also expects to see design-build used for some smaller projects.
- Virginia has 30 active design-build contracts totaling $1.3 billion, four active proposals totaling $637 million (the largest of which is the $480 million I-64 Southside Widening and High Rise Bridge project), and six planned projects worth $610 million.
- Georgia is currently under way with a $14 billion major mobility improvement program which consists of 11 major projects, and expects to have several design-build procurements in the upcoming two fiscal years, including local bridge bundling and interstate expansion projects.
- Florida awarded the $398.5 million Pensacola Bay Bridge contract in July 2016, and plans to let one section of the Wekiva Parkway project, the $556 million I-395 project and the $323M Gateway Express project in FY 2017.
- Colorado recently completed the $72 million I-25 North Express Lanes.

Forty states and Washington, D.C. also used $13.7 billion in federal funds to support over $30.1 billion in design-build projects during the last decade. Planning and design work accounted for $3.3 billion or just over 10 percent of total costs. Eight states—Florida, Virginia, California, Pennsylvania, South Carolina, Minnesota, Ohio and Texas—generated 78 percent of the design-build market activity that used federal funds.

Some of the largest design-build projects that received approval for federal funding in the last decade include the replacement of the Tappan Zee Bridge in New York; construction of segments D-G of the Grand Parkway (SH 99) in Texas; the Intercounty Connector in Maryland; the Ohio River Bridges Downtown Crossing project in Kentucky and Indiana; the State Highway 183 reconstruction and managed lanes project in Texas; the SR 91 Corridor Improvement Project in California; the Port of Miami Tunnel in Florida; the Triangle Expressway project in North Carolina; the Safe and Sound Bridge Improvement Project in Missouri; and the Eleventh Street bridge project in Washington, D.C.
**Staffing and Employment Issues:** A number of state DOTs are concerned about losing experience through retirements or attrition. Without the ability to develop expertise in house, some agencies are supplementing their staff by hiring consultants. This will continue to be a challenge for the industry in the years to come as the workforce ages.

![Real value of state DOT & local government right of way purchases for highways, streets & bridges](image)

Source: ARTBA estimates based on forecast model and FHWA data. Nominal values have been deflated with the ARTBA Price Index, which takes into account material prices, project costs, general inflation and industry wages.

![Real value of state DOT & local government planning & design outlays for highways, streets & bridges](image)

Source: ARTBA estimates based on forecast model and FHWA data. Nominal values have been deflated with the ARTBA Price Index, which takes into account material prices, project costs, general inflation and industry wages.
The railroad, subway and light rail market is forecasted to grow from $19.3 billion in 2016 to $20.3 billion in 2017, according to ARTBA’s forecast model.

After declining in 2016, work by Class 1 freight railroads is expected to grow from $11.9 billion to $12.7 billion. Transit, subway and light rail work is forecasted to grow to $7.7 billion, up from $7.4 billion last year.

Future growth will be supported by additional transit investments through the FAST Act, the growing U.S. economy, demand for freight rail services, the continued production of U.S. oil and the recently completed expansion of the Panama Canal.

Some of the major ongoing subway and light rail projects across the country include:

- East Side Access, New York, New York ($10.8 billion)
- Phase 1 of the Honolulu Rail Transit project, Honolulu, Hawaii ($6.6 billion)
- Components A, B, and G of the Eagle P3 project (East Rail, Northwest, and Gold Lines), Denver, Colorado (three projects, totaling $6.3 billion) Silicon Valley Berryessa Extension Project, San Jose, California ($2.3 billion)
- Phase 1 of the Second Avenue Subway project, New York, New York ($4.9 billion)Mid Coast Corridor Transit Project, San Diego, California ($2.1 billion)
- World Trade Center Transportation Hub, New York, New York ($3.7 billion)
- Phase 1 of the Purple Line Extension project, Los Angeles, California ($2.8 billion)
- Phase 2 of the Silver Line project, Washington, D.C. ($2.8 billion)
- BART Silicon Valley Berryessa Extension, Bay Area, California ($2.3 billion)
- Mid-Coast Corridor Transit, San Diego, California ($2.1 billion)
- Northgate Link, Seattle, Washington ($2.1 billion)
- Crenshaw Line, Los Angeles, California ($2.1 billion)

There were four new construction starts for commuter and metro rail in 2016:

- $2.8 billion East Link light rail project in Seattle, Washington (estimated completion in 2023)
- $2.1 million for the Purple Line project in Washington, D.C. (estimated completion in 2021)
- $1.5 billion Caltrain Electrification and Modernization in the Bay Area of California (estimated completion in 2021)
- $881.0 million TEX Rail project in Dallas, Texas (estimated completion in 2018)

Construction also began on the second phase of the $150.00 million CityLYNX Gold Line streetcar project in Charlotte, North Carolina, and on four bus rapid transit projects totaling $293.0 million across the country.
Some additional factors that could impact this market:

**U.S. Economic Growth**: The overall health of the private railroad industry and the U.S. economy are key drivers of the national railroad construction market. There are seven Class 1 freight railroads in the United State and over 560 smaller, regional railroads. As the U.S. and the global economy improves and demand for freight services increases, these companies will continue to invest in their infrastructure.

Demand for freight transportation is projected to rise, following trends in population and economic growth. However, growth will be tempered somewhat after strong 2014 and 2015 levels. Total rail traffic volume in the U.S., which includes U.S. carload traffic and intermodal units, was down 6.6 percent in the first 10 months of 2016 compared to 2015. Rail traffic is also down compared to 2013 and 2014 levels. According to the Association of American Railroads, this decline is due to challenges faced by manufacturing, including slowdowns in the energy sector; carloads of coal have decreased by 23.8 percent and carloads of petroleum and petroleum products have fallen by 22.3 percent in the first 10 months of 2016, compared to 2015.

Intermodal rail traffic has decreased as well, falling by 3 percent year over year from 2015. Freight railroads estimate they will spend approximately 16 percent less on capital and maintenance expenditures in 2016, after reaching an annual record of $29 billion in 2015. Most of this spending will go toward infrastructure upgrades, replacing older assets, new equipment and locomotives, PTC, and improving the network’s safety and resiliency. In addition, some freight railroads plan to trim their workforces, cutting at least 2,200 jobs in 2016 due to declining revenues, income and earnings. 3

- BNSF, which is the largest oil shipper in North Dakota’s Bakken and Three Forks shale formations, planned to spend a $4.1 billion in 2016 to improve its system after a record $5.8 billion investment in 2015. The largest component of expenditures in 2016 is $2.7 billion to replace and maintain the railroad’s core network and related assets, though $500 million will go towards expansion projects. Over $1 billion in capital expenditures will be focused in eight states: $180 million each in California, Illinois and Montana; $140 million in Missouri; $110 million in Nebraska; and $100 million each in Colorado, Kansas and North Dakota. These capital projects largely focus on maintenance, including replacing and upgrading rail, ties and ballast, adding capacity, purchasing equipment, implementing Positive Train Control, and addressing rail bottlenecks in Chicago. U.S. grain supplies are at their highest levels in almost 30 years after three consecutive large crops, incentivizing farmers to store grain until commodity prices increase. 4
- Union Pacific planned to spend $3.7 billion in 2016, down 14 percent from 2015 levels; half of this investment is for infrastructure replacement. 4 CSX Corporation, another major Class I railroad, planned to spend $2.4 billion on capital expenditures, a slight decrease from the $2.5 billion spent in 2015 and in 2014. 5

**The FAST Act**: The FAST Act increases federal public transportation investment from the current $10.7 billion to $12.6 billion by FY 2020. Transit capital investment grants will increase from $1.9 billion in FY 2015 to $2.3 billion in FY 2016 and this level of investment is maintained through FY 2020.

The new law includes language allowing up to eight transit capital projects that are part of a public-private partnership to be considered for fast-track approval process as long as the projects receive less than 25 percent of funding from the federal program. This builds on a similar pilot program created in MAP-21 that allowed for three projects receiving less than 50 percent federal funds to receive the expedited approval process.

It also contains $200 million for Positive Train Control (PTC) upgrades—a rail safety capital technology program being mandated at the federal level with the intent of cutting down on train crashes. The funds for this initiative come from the HTF’s Mass Transit Account.

**Increase in Freight Shipments**: U.S. rail traffic has not yet recovered from the Great Recession; despite increases in 2014, rail traffic has not returned to pre-recession levels, according to the American Association of Railroads. Specific commodities such as crude oil have experienced massive growth in recent years, though this growth has slowed in 2015 and 2016. 6 Improved intermodal service, including large investments in new and expanded inland and near-dock intermodal terminals, spurred growth in intermodal traffic in 2015, though intermodal traffic has decreased in the first 10 months of 2016. Despite declining rail traffic, railroads are continuing to conduct maintenance work and expand capacity. Additionally, projected increases in rail freight tonnage are expected to spur future investments in heavy rail construction in the next five years. 7

**The U.S. Oil Boom**: In 2011, the United State became a net exporter of petroleum products for the first time since 1949. This domestic tight oil boom is changing the network of rail traffic, as demand continues increasing to move the oil currently bottlenecked in the middle of the country. Absent new large pipelines, more railcars and lines are being utilized to transport more railcars and lines are being utilized to transport oil from the new shale areas to refineries, driving increases in North American rail traffic. 8 Other operators are choosing to vent or flare gasoline, with almost
The 2017 U.S. Transportation Construction Market Forecast

**Real value of railroad construction**

<table>
<thead>
<tr>
<th>Year</th>
<th>Value In Billions 2016$</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
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</tr>
<tr>
<td>2010</td>
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</tbody>
</table>

Source: ARTBA forecast model. Measuring U.S. Census Bureau Value of Construction Put in Place. Nominal values have been deflated with the ARTBA Price Index, which takes into account material prices, project costs, general inflation and industry wages.

**Total U.S. Rail Freight Tonnage 2015 – 2045**

<table>
<thead>
<tr>
<th>Year</th>
<th>Millions of Tons</th>
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<td>2015</td>
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<tr>
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<td>2040</td>
<td>2,175</td>
</tr>
<tr>
<td>2045</td>
<td>2,295</td>
</tr>
</tbody>
</table>

Source: Freight Analysis Framework
The long-anticipated Keystone XL crude oil pipeline was planned to transmit crude oil from Canadian tar sands to the United States. However, in November 2015, President Obama rejected TransCanada’s application for a permit to construct the Keystone XL pipeline. The cancellation of this proposed pipeline increased demand for rail transportation of crude oil from the U.S. Midwest to refineries. In 2010, less than 24 million barrels of crude oil were transported by rail in the United States; by 2014, that number had jumped to over 382 million barrels. Though crude oil transportation by rail remains at a high level historically, carloads of crude oil decreased in 2015 and during the first half of 2016 from its 2014 peak.

This recent surge in domestic crude oil output led to an oversupply of crude oil, resulting in a sharp decline in crude oil prices in 2014 and 2015. However, oil prices have been increasing since the beginning of 2016, which has led to a decline in the amount of domestic crude oil produced — and how much railroads haul across the country.

**Positive Train Control:** All Class I railroads are continuing investments in PTC, and expect to have the system fully implemented by 2018, following a 2015 extension of the deadline from Congress. To date, railroads have spent almost $6.5 billion on PTC development and deployment, with over $1.6 billion planned expenditures in 2016 alone. In 2016, Union Pacific planned to spend $390 million to further implement PTC, 10 percent of total capital expenditures. BNSF planned to spend $300 million for the continued implementation of PTC in its 2016 capital plan, Norfolk Southern planned to spend $246 million, CSX planned to spend $300 million, and CN planned to spend $400 million.

**High Speed Rail:** Investment from federal, state, local and private companies continues along the national high-speed intercity passenger rail corridors, which include some freight rail lines. Nearly 85 percent of investments are concentrated on six key corridors and five key mega-regions across the country, comprising 33 states and the District of Columbia. As of November 2016, there is $8.6 billion in ongoing or completed work on 69 projects under the high-speed intercity passenger rail program at the Federal Railroad Administration, out of $10.1 billion in total program funding. Eighty two of these projects are substantially complete, and 22 more are expected to be complete in the next six months. By early 2017, an additional three projects totaling $960 million are expected to be underway. California is the state leader in high-speed rail; $4.2 billion has been awarded in the state thus far, 43% of total high-speed rail awards. Over 92 percent of California’s high-speed rail awards ($3.9 billion) are for the state’s high-speed rail corridor between Los Angeles and San Francisco. The second-largest high-speed rail corridor is the Chicago-St. Louis corridor, which has been awarded $1.3 billion for work in Illinois and Missouri.
Private companies have begun to enter the high-speed rail market in the U.S.; a private Texas company, Texas Central, is pursuing a $10 billion high-speed rail line between Dallas and Houston and in October 2015 selected a contractor to perform engineering and pre-construction work. Despite some challenges in purchasing the land for the rail line, construction is expected to begin as early as 2017 and begin operations in 2021.14

Transit Connections to Airports: According to the 2017-2021 FAA National Plan of Integrated Airport Systems, linking commercial service airports with public rail transit has become increasingly popular. Today, 28 airports are connected to rail transit, and five of those airports are served by more than one rail mode. Between 2017 and 2021, airports across the country are expected to spend $758 million towards airport ground access, including highways and transit. Some plans currently in the works include a rail extension to Denver International Airport (expected to open in 2016), an extension of the Washington Metro Silver Line to Washington-Dulles International Airport (expected to open in late 2019) and a rail connection to Honolulu International Airport (the entire system is expected to open in 2019). These transit connections are geared toward reducing congestion and traffic delays on roads as well as reducing travel time to airports. Airports may fund the portions of transit links that are dedicated on-airport (and airport-owned) through passenger facility charges. 15

TIGER Grants for Rail & Transit: In the last three fiscal years, the U.S. Department of Transportation (DOT) has awarded $233.7 million in TIGER grants to freight rail-related projects valued at $1.0 billion. Over the same time period, U.S. DOT awarded $562.7 million in TIGER grants for $2.1 billion in transit-related projects. This funding will help boost the market place over the next few years as projects get underway. In 2016 alone, 48 percent of awarded TIGER grants were for freight or transit-related projects. These projects include the $262.4 million Redlands Passenger Rail Project in California, which received a $8.7 million TIGER grant, the $137.2 million Rosecrans/Marquardt Grade Separation project in Los Angeles County, California, which received a $15.0 million TIGER grant, a $75.7 million project to improve connectivity and access to Utah’s transit system, which received a $20.0 million TIGER grant, and the $67.2 million US29 Bus Rapid Transit (BRT) Improvements project in Montgomery County, Maryland, which received a $10.0 million TIGER grant.

TIFIA Program: There are currently 15 transit projects that have active credit agreements under the TIFIA program. These include the Dulles Corridor Metrorail Project (a $5.7 billion project) in Virginia, the East Link Extension project ($4.0 billion) in Washington, section 1 of the Westside Purple Line Extension project ($2.6 billion) in California, the Eagle project ($2.1 billion) in Colorado and the Crenshaw/LAX Transit Corridor project ($1.7 billion) in California. Three other transit projects have submitted a Letter of Interest for a TIFIA loan and are at various stages in the review process.

The Panama Canal Expansion & Intermodal Shipments: The historic Panama Canal expansion was completed in June 2016, spurring increased investment in U.S. railways.16 Before construction was complete, the U.S. Maritime Administration predicted that post-Panamax ships would make fewer port calls with increased container volumes, thereby stressing those ports that would receive these larger ships and creating an immediate need for increased landside capacity to avoid congestion.

In this new environment, with higher peak loads and ports competing for a decreasing number of large cargo ships, the most attractive ports will be those with greater storage and handling capacity and efficient intermodal connections to inland destinations. Of particular importance are intermodal rail and “last mile” terminal and port connections.

This trend is evidenced by the continued high volume of intermodal rail traffic by class I railroads, despite a decrease in 2016 from record 2015 levels. Many railroads have undertaken large investments in new and expanded inland and near-dock intermodal terminals and track upgrades, as exports and imports account for half of U.S. rail intermodal traffic. Intermodal is increasingly important to class I railroads; in 2015, it was the largest single source of freight rail revenue in the U.S. Containers accounted for 89 percent of intermodal traffic in 2015. With the growth in container volumes, these intermodal terminals are increasingly important. These near-dock intermodal terminals facilitate the transfer of containers between ship and rail. Other intermodal investments by railroads include raising clearances along rail routes to allow for the increased height of double-stack trains, adding track capacity to accommodate more frequent and faster trains and adding new intermodal car types through their networks. 17
Some specific examples of investment include:

- The Port of New York and New Jersey, which handles around one third of the containerized cargo that moves across the Eastern Seaboard, is expanding its Express-Rail program to improve rail access to the port and increase the share of container traffic transported by rail; in addition to $600 million already invested in the program, a fourth ExpressRail at Port Jersey-Port Authority Marine Terminal is planned. In its 2014-2023 Capital Plan, the Port Authority of New York and New Jersey includes the $438 million construction of an intermodal facility and other improvements at Greenville Yard. The project has stakeholders such as CSX, Norfolk Southern, Port Jersey Railroad and the NY/NJ Rail Corporation, and is expected to be completed in 2019.

- In partnership with the Florida East Coast Railway, Port Everglades opened a $53 million onsite intermodal container transfer facility in 2014, which allows the direct transportation of cargo to the national rail network. Since the project’s completion, the port has received over one million Twenty Foot Equivalent Units (TEUs, the unit of the capacity of a container ship) each fiscal year. According to the Port Director, the port is three years into a 20-year master plan to accommodate increased container volumes; so far $1.6 billion has been spent on building five new berths, adding new post-Panamax cranes and making extensions to the turning basin.18

- In 2015, PortMiami completed the construction of a new on-dock intermodal rail service in partnership with the Florida East Coast Railway to accommodate larger ships.19

- In April 2016, the Port of New Orleans opened a new $25 million dockside intermodal terminal, funded by a $16.7 million TIGER grant. As the only deep-draft port served by the six major Class 1 railroads, New Orleans has increased container movements by rail, in addition to starting a container-on-barge service from Baton Rouge to New Orleans for the export market.20

- The Georgia Ports Authority has been upgrading road and rail connections at the Port of Savannah, and the Port of Miami extended on-dock rail and connected the port to its Hialeah intermodal rail yard.21

**Shoring Up Disaster-Damaged Infrastructure:**

Large storms over the past several years have caused damage to transportation infrastructure, refocusing state and local investment on repair work but also on increasing resiliency in the face of future storms. After the devastating storm that struck the East coast in September 2012, many transit facilities were damaged, particularly in New York and New Jersey. Storm damage to New Jersey’s transit system alone was estimated at roughly $400 million.

In addition to repair work, these states are also focusing on shoring up existing infrastructure to prevent future damage and disruption of service. In New Jersey, NJ TRANSIT is underway with a Superstorm Sandy Disaster Recovery and Resilience program that includes repair and preventative maintenance. In early fiscal year 2015, NJ TRANSIT was awarded $1.28 billion from the Federal Transit Administration to fund five resiliency projects. In fiscal year 2016, NJ TRANSIT completed four projects, including a $6.9 million repair of cables, switches, heaters, etc. on the Hudson-Bergen Light Rail line and the $5.8 million replacement of emergency ventilation fans at Penn Station. After budgeting $913 million for Sandy Competitive Resiliency projects in its FY 2016 Capital Program, NJ TRANSIT allocated $16.3 million for repair, recovery and resiliency projects associated with Superstorm Sandy in its FY 2017 Capital Program.22

The Port Authority of New York and New Jersey, in its 2014-2023 Capital Plan, projects that it will spend $1 billion on 57 projects over the next 10 years through its Storm Sandy Program. The program includes permanent repair work to the PATH system, which will make up over half of capital spending. The remainder of spending will focus on long-term repair and resiliency projects to help protect other assets from future storms.

Federal, state and local partners are pursuing the construction of new passenger rail tunnels under the Hudson River between New York and New Jersey. The current tunnels, which are over 100 years old and owned by Amtrak, were damaged during Hurricane Sandy and must be closed for repairs, however limiting trains to one tunnel would cause major delays for the New York City metro region. In October 2016, Secretary Foxx said that the project is designated a priority, and will get accelerated and streamlined environmental and permitting reviews, allowing construction to begin in 2019. The project is estimated to cost $24 billion and be completed as early as 2024.23
This large-scale project consisted of deepening and widening the Pacific and Atlantic openings of the canal, constructing a separate access channel, and modifying existing canal infrastructure. The canal's new locks are 30% larger than current locks and allow more ships to pass through the canal on a given day. The canal is now able to accommodate ships that are twice as large as before the expansion.
Airport terminal and runway construction is forecasted to reach $13.2 billion in 2017, up from $13.1 billion in 2016. Construction activity is expected to grow over the next five years with modest increases in passenger travel and economic activity.

Overall demand is the main driver of airport construction investment, which is underpinned by economic activity. After a short uptick in passenger growth in 2015 and 2016 due to the decline in the price of oil, U.S. passenger growth is expected to increase modestly over the next 20 years, at a slightly faster rate than last year’s forecast.

Despite challenges in the U.S. and global economy in 2015, domestic airlines saw record profits that year due to low energy prices and stable demand. This profitability and growth is expected to continue in the near term. Total passengers to and from the United States on U.S. and foreign flag airlines have been increasing each year since 2009. Higher levels of activity increase revenues for construction market activity through more airport operations, passenger facility charges and demand for flights. An increase in the number of airplanes and flights also requires more runway maintenance. Investment in airport construction is financed by federal, state and local grants, bond proceeds, passenger facility charges, airport-generated revenues and tenant and third-party financing. Many projects are financed through airport revenue bonds.

There is $32.5 billion in planned infrastructure projects from 2017 to 2021 that would be eligible for the federal Airport Improvement Program (AIP), according to the Federal Aviation Administration (FAA). This includes work at 3,340 existing and proposed airports that are part of the FAA’s National Plan of Integrated Airport Systems (NPIAS). These airports are considered to be significant to national air transportation. This is a $1 billion, or 3 percent, decline from the last NPIAS forecast, largely due to a 1.9 percent increase in construction costs, the deferral of some AIP-eligible projects, and the exclusion of terminal projects, which include rehabilitation and expansion, from the NPIAS report because they are generally funded with passenger facility charge revenue.

The FAA has awarded $3.00 billion in AIP grants in fiscal year 2016, down slightly from $3.20 billion awarded in fiscal year 2015.

AIP grants increasingly fund rehabilitation and maintenance work, including pavement reconstruction, bringing airports up to design standards, and terminal building expansion and rehabilitation; capacity-related development is decreasing following over a decade of major capacity projects. Large and medium airports are expected to see a decrease in AIP-eligible development; however development at small airports is expected to increase.
There are eight new airports in Alaska, Georgia, Iowa, Illinois, North Dakota and New Mexico that will be open or under development within five years; the FAA estimates that this development will cost over $127 million total.  

There are currently eight major airport expansion projects costing over $1 billion each. These airport expansions include terminal, runway, connectivity and other projects at Hartsfield-Jackson International Airport, Nashville International Airport, Orlando International Airport, Los Angeles International Airport, Dallas Fort Worth International Airport, Denver International Airport, Dulles International Airport, and Salt Lake City International Airport. According to the FAA, Chicago's O'Hare International Airport is projected to have the largest development costs of any other airport in the next five years, at $740.8 million.  

Some of the factors that will influence the airport terminal and runway construction market include:

Reauthorization of the Airport Improvement Program (AIP): On July 15, 2015, President Obama signed the FAA Extension, Safety, and Security Act of 2016 in to law, which extended the Airport Improvement Program through Sept. 30, 2017. AIP funding, which is used for runway and other capital improvements at airports, continues to face a declining real value as project costs and inflation increase over the next few years while funding levels have been stuck at or below $3.5 billion for the past decade. And as the economy continues to recover and demand for air travel increases, airports will require more maintenance and expansion, making a new and more robust airport funding bill critical in the coming year.

Demand for Air Passenger Transportation: Demand for air services will be modest over the next five years after an uptick in 2015 and 2016. The FAA forecasts that domestic enplanements will be up 4.2 percent in 2016 and will slow to an average annual rate of 2 percent over the next five years. International demand for travel between the United States and the rest of the world continues to increase at a steady rate as well; total passenger traffic on U.S. and foreign flag carriers is projected to increase by 3.5 percent in 2016 and average 3.9 percent growth over the next five years.

Demand for Air Freight Transportation: Domestic air cargo revenue per ton miles is forecasted to increase by 2 percent in 2016 and by 1.4 percent annually over the next five years, according to the FAA, driving further construction activity in both runway and terminal work. Some factors that have contributed to this slowed growth in air cargo growth include: modest growth in U.S. GDP, which is the primary driver of domestic air cargo activity; fuel price volatility; TSA and FAA air cargo security regulations (which are expected to remain in place); and a shift by the U.S. Postal Service and carriers such as FedEx from air to other modes (particularly truck transport) to transport mail, in addition to mail substitutes like email or cloud-based services. Additionally, all-cargo carriers are making up a larger proportion of domestic cargo revenue per ton miles; by 2036, all-cargo carriers are expected to carry 90.8 percent of domestic cargo due to increasing cargo carrier capacity as well as security considerations.

Increased Pavement Maintenance Work: Congress has authorized the FAA to allow the use of AIP grant funds for routine pavement maintenance at non-hub airports.

Airport Congestion: The U.S. air transportation system is estimated to handle over one billion passengers in 2016 and continue increasing; by 2025 U.S. airports will see a 26 percent increase in traffic from current levels. Without continued expansion and maintenance of the airport system, passengers will struggle with increasing congestion and gridlock.

The FAA has identified five airports in three metro areas that need additional capacity by 2020, even with NextGen and after any planned improvements are made—Atlanta (ATL), New York (JFK, EWR, LGA), and Philadelphia (PHL). Absent midterm NextGen improvements, San Francisco International Airport (SFO) will also need additional capacity by 2020. These midterm NextGen improvements will reduce congestion at airports.

Four of the six airports listed above have also been identified as airports where demand consistently exceeds capacity, resulting in delays across the entire system; at JFK, EWR, LGA, SFO, as well as Chicago O’Hare International Airport (ORD) and Los Angeles International Airport (LAX), it is unclear whether measures to increase capacity are feasible in the near term. To that end, short-term solutions have been implemented at some of those airports, like the FAA's temporary cap on scheduled operations at New York metropolitan airports (which will continue at JFK and LGA through October 2018), an International Air Transport Association Level 2 designation (which enables FAA to request
all carriers at an airport report all their proposed scheduled operations, therefore allowing FAA to monitor traffic levels and prevent excessive delays) at EWR, ORD, SFO, and LAX, and studies to identify alternatives for further evaluation. 36

Currently, the FAA recommends that capacity planning start when airport activity reaches 60 to 75 percent of airfield capacity, since major airfield improvements often take 10 or more years from concept to opening.

**Additional Factors:** Airport construction will also be impacted by other industry trends, such as larger aircraft, airport privatization and the conversion of military airports for civilian use. The Airbus A380 and Boeing 747-8 are 2 aircraft that require additional space because of their fuselage length, wingspan and weight. Currently there are seven airports that receive the A380 and 24 airports which have received approval to accommodate the B-747-8. Under the FAA Modernization and Reform Act of 2012, the pilot program for privatizing airports was expanded from five to 10 facilities. Eight slots in the pilot program are currently available. 37 There are also seven former military airfields that are currently being converted to civilian use through the FAA’s Military Airport Program. 38 There are possible construction opportunities in these areas when airports are being upgraded or restored for civilian use.

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**Source:** U.S. Department of Transportation Federal Aviation Administration FY 2016-2036 Aerospace Forecast
Real value of airport runway construction

Source: ARTBA forecast model. Measuring U.S. Census Bureau Value of Construction Put in Place. Nominal values have been deflated with the ARTBA Price Index, which takes into account material prices, project costs, general inflation and industry wages.

Real value of airport terminal & related construction

Source: ARTBA forecast model. Measuring U.S. Census Bureau Value of Construction Put in Place. Nominal values have been deflated with the ARTBA Price Index, which takes into account material prices, project costs, general inflation and industry wages.
The value of port and waterway work is expected to grow slightly to $2.1 billion in 2017, with an uptick in both port and terminal work.

The main sources of market activity are from the Army Corps of Engineers’ Civilian Works Program and from investments in public and private ports. Some of the work in this area includes upgrading port facilities, dredging deeper channels, replacing locks and dams and relieving traffic congestion around ports.

According to a 2015 American Association of Port Authorities report, U.S. ports need at least $28.9 billion in upgrades to intermodal links to roads, bridges and transit over the next 10 years to handle the heavy volume of expected freight as port activity increases due to growing international traffic. One third of ports need at least $100 million invested in port intermodal connectors through 2025.

Some major ongoing and upcoming projects include:

- The Georgia Ports Authority is underway on a $706 million deepening expansion of the Savannah Harbor, which is expected to be completed in late 2020 or early 2021. Georgia has advanced its share of $266 million, and now awaits federal funds to maintain current dredging work. 39
- In Texas, the Port of Corpus Christi has received approval from Congress to deepen its port to 52 feet to allow post-Panamax ships and keep pace with increased traffic due to manufacturing and energy production. This over $300 million project is on hold until it receives federal funds; pending federal appropriations, this project is expected to get under way in 2017. 40
- The Port of Los Angeles, one of the nation’s top 10 ports both by volume delivered and port calls, has a budget for FY 2015-2016 of over $1.1 billion, 18 percent of which is going towards capital expenditures. Nearly $104 million will be dedicated to terminal development and transport projects, as the expansion of the Panama Canal increases competition between East Coast and West Coast ports. 41
- The U.S. Army Corps of Engineers continues work in Louisville on the Olmsted Locks and Dam, which is expected to be completed by 2018. The 2014 WRDA bill included a provision for at least $150 million annually to complete the locks and dam project. 42
- Port Manatee in Florida plans to deepen its channels and berthing facilities in anticipation of the opening of the enlarged Panama Canal. This multi-million dollar project would take up to eight years to complete, but would make Port Manatee a major destination for heavy load ships. In 2017, the Port will undertake a $700 thousand federally-funded study to evaluate whether it will be able to handle expansion. 43
• In October 2015, Baltimore announced a plan to invest $27.5 million for infrastructure improvements at the Port of Baltimore, funded by a $10 million TIGER grant. This investment will fund the Southeast Baltimore Port Industry Freight Corridor Plan. 44
• North Carolina allocated an annual $35 million to the N.C. State Ports Authority in its most recent biennial budget.

Some of the factors impacting the market outlook for this sector include:

**The Water Resources and Development Act (WRDA):** Early in the summer of 2014, the House and Senate almost unanimously passed the updated WRDA bill, which aims to streamline the project-delivery process. The final $12.3 billion water resources bill was signed into law by the president in June, the first water resources reauthorization issued in seven years. Prior to 2000, WRDA bills were authorized every 2 years.

In addition to strengthening water infrastructure, the new bill de-authorizes $18 billion of old, inactive projects and sunsets authorizations to prevent future backlogs. The new WRDA also establishes a new Water Infrastructure Public Private Partnership (P3) Program in order to facilitate private market funding for major projects.

A reauthorization of WRDA, the Water Resources Development Act of 2016 (S.2848), was passed by the Senate on Sept. 15, 2016. The Senate version of the WRDA bill identifies approximately $9 billion in navigation, flood control and environmental restoration projects that are eligible for Congress to fund. If this bill is passed in its’ current form, it would update the cost-share formula for harbor deepening projects from 45 to 50 feet, extend funding authorization for donor and energy-transfer ports, streamline and expedite procedures for completing existing projects, and authorize dredging projects in eight ports to deepen navigation channels, including the Port of Charleston in South Carolina and Port Everglades in Florida. 45

On Sept. 29, 2016, the House of Representatives passed its’ own version of the WRDA reauthorization, the Water Resources Development Act of 2016 (H.R.5303). The House and the Senate are currently negotiating the differences between their bills, and hope to have a final bill for the President to sign into law by the end of 2016.

**TIGER Grants:** U.S. DOT has approved six TIGER grants totaling $61.8 million for maritime projects, up from the previous year. This year’s TIGER grants fund port and waterway projects valued at $168.3 million. This additional funding will help support market activity and growth. Among the TIGER grants awarded are a $17.6 million award for $49.6 million in maritime improvements at the Port of Albany in New York and a $10.0 million award for the $55.5 million Port of Everett South Terminal Modernization project in Washington.

**Expansion of the Panama Canal:** The expanded Panama Canal began its commercial operation on June 26, 2016. This $5.25 billion project increased the capacity of the Panama Canal by adding a new lane of traffic to accommodate more ships, and widening and deepening existing lanes and locks to allow larger vessels to pass, up to three times the size of ships that previously passed through the canal. Less than a month after the expansion was complete, the Panama Canal had already ousted the Suez Canal as the leading route between the Far East and the U.S. East Coast, with a 57 percent share of total trade volume compared with 48 percent at the beginning of the year. 46 According to the Panama Canal Authority, the canal is expected to see up to an additional 15 percent more tonnage in 2017, due to increased container shipping and the addition of liquefied natural gas (LNG) and liquefied petroleum gas (LPG) shipments. 47

Currently there are four East Coast ports— Baltimore, Hampton Roads, Miami, and New York and New Jersey—that are able to handle the new mega-ships that will pass through the Canal, with maximum channel depths of 50 feet. Charleston, Jacksonville and Savannah are all major ports of call, but currently have depths of 45 feet or less, making them less capable of handling the larger ships that will pass through the expanded Canal. 48

Some of the major related projects include:

• PortMiami finished dredging its waters to 52 feet in September 2015, making it the deepest port south of Virginia and placing it as one of the first calls for larger post-Panamax ships once the canal expansion is complete. The project, which cost $220 million, was funded by state and local dollars after federal delays led Florida Governor Rick Scott to say the state would pay the federal government’s $77 million share and seek reimbursement later. 49
• The Port of New York and New Jersey completed its’ $2.1 billion harbor deepening project in September 2016, becoming the fourth East Coast port able to accommodate the larger post-Panamax ships. This project had been previously delayed significantly by shoals and debris accumulated during Hurricane Sandy in 2012. 50
• In March 2016, the Massachusetts Port Authority Board voted to approve the Boston Harbor Dredging Project. The $310 million project, which is scheduled to begin
in late December 2016, will deepen the main shipping channel at the Port of Boston from 40 feet to 51 feet.  

- The Ports of Long Beach and Los Angeles are together investing over $7 billion in a plan to make room for post-Panamax ships, including the replacement of the Gerald Desmond Bridge to provide more clearance for taller ships, and a $1.2 billion upgrade of the two harbors to create a single, more automated port that can handle ships carrying up to 22,000 containers. The Long Beach Middle Harbor Project is set to be fully online by 2020.  
- The Port of Savannah is currently underway with its $706 million dredging project, which is expected to be completed by early 2021.  
- Port Everglades is expected to begin construction in 2018 on it harbor deepening and widening project, which will cost approximately $374 million, partially funded by $190 million in federal funds. Construction is expected to be completed between 2021 and 2023.  
- Port Houston is undertaking significant infrastructure improvements to accommodate larger post-Panamax ships; in 2016 the port approved a capital budget of $314 million for infrastructure projects. Currently, Port Houston is making improvements at the Barbour’s Cut and Bayport Channels, including reconstruction of container years and channel deepening and widening.  
- A $300 million project to deepen the Port of Corpus Christi’s channel to 52 feet was authorized by Congress in 2007 and in 2014, but the port does not have the funding needed to pay for the project’s construction.  

The Panama Canal expansion will also continue to change international shipping movements; according to a 2015 report by the Boston Consulting Group and C.H. Robinson, up to 10 percent of container traffic from East Asia to the United States could shift from West Coast ports to East Coast ports as more post-Panamax ships pass through the canal. Since East Coast ports already receive about 35 percent of East Asian container traffic to the U.S., this could mean that over half of East Asian U.S.-bound traffic would arrive at the East Coast by 2020.  

Ports across the country are expected to invest at least $154 billion through 2020 to pay for new facilities, equipment, expansion, modernization and repair investments, according to a recent survey by the American Association of Port Authorities. This is three times more than the planned capital expenditures level from the survey conducted five years ago. Capital expenditures will focus on investments in rail, terminals, piers, equipment, security and expansions, with ports focusing on navigation dredging, facility rehabilitation, and rail and environmental improvements, and private-sector partners focusing on bulk-handling and energy transfer facilities as well as storage.  

Almost all of that planned investment (83 percent) will be concentrated in Gulf Coast ports, which are planning new energy processing, production and transfer facilities in response to the recent construction of many new petrochemical processing plants in Texas and Louisiana, as well as continued growth in fuel, farm products and manufactured goods exports. According to the Petrochemical Update, the value of industrial construction put in place in Texas and Louisiana is expected to total $361 billion between 2015 and 2020.
Real value of port & waterway construction

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Source: ARTBA forecast model. Measuring U.S. Census Bureau Value of Construction Put in Place. Nominal values have been deflated with the ARTBA Price Index, which takes into account material prices, project costs, general inflation and industry wages.

Total Projected Port & Private Capital Expenditures for 2016-2020, by Port Region (in billions)

- North Pacific, $4.03
- South Pacific, $7.71
- North Atlantic, $4.86
- South Atlantic, $9.38
- Great Lakes, $1.01
- Gulf Coast, $127.79

Source: American Association of Port Authorities 2016-2020 Port Planned Infrastructure Investment Survey
The outlook for the transportation equipment market is expected to be positive in the coming year as companies replace aging equipment, though growth will continue at a slower pace than last year, according to a survey of ARTBA members. About 12 percent of companies plan to expand their fleets in addition to replacing equipment in need of repair, a slight increase from the 10 percent that planned to expand their fleets in 2016 and a drop from the one third of companies that planned to expand their fleets in 2015. Slightly fewer companies plan to maintain their fleet size in 2017, compared to 2016. At the same time, half of fleets are in need of repair or replacement, up from levels in prior years. Of those companies that indicated that their fleets needed repair or replacement, most (71 percent) plan to purchase, rental purchase, lease or acquire equipment from an auction or a private party in 2017.

According to the survey results:
- The majority of companies plan to maintain their current fleet size as they replace aging vehicles for various types of equipment, including earthmoving (70 percent of respondents), paving and compaction (80 percent) and other types of equipment (80 percent).
- Less than 15 percent of respondents are planning to increase their fleet size, including making purchases for earthmoving (10 percent), paving and compaction (11 percent) and other types of equipment (14 percent).
- The remaining contractors plan to reduce their fleet size for earthmoving (20 percent), paving and compaction (9 percent) and other equipment (6 percent).
- Most new equipment will be acquired through a direct purchase for earthmoving (61 percent), paving and compaction (52 percent) and other types of equipment (58 percent), versus using an auction or a private party.
- Many contractors agreed that their fleet is in need of replacement due to age or poor condition, including machines used for earthmoving (53 percent), paving and compaction (39 percent) and other types of activities (58 percent), up from levels seen last year and the year before.
- Of those companies that indicated that their fleets needed repair or replacement, most plan to acquire equipment for earthmoving (65 percent), paving and compaction (71 percent) and other types of equipment (71 percent).
The use of public-private partnerships (P3s) continues to be an important tool for funding highway and bridge construction projects. Five highway-related P3 projects came to financial close in 2016, totaling over $3.3 billion in investment.  

Between 1989 and 2011, 24 states and the District of Columbia used a P3 process to help finance and build at least 96 transportation projects worth a total of $54.3 billion. Over half of the projects, 65 percent, have occurred in eight states. Traditionally P3s have accounted for 2 to 5 percent of annual highway and bridge construction market activity, and are an important financing tool for new capacity.

The federal government plays a large role in supporting P3 projects, primarily through private activity bonds (PABs), which can be issued on behalf of private developers by a government agency at tax-exempt rates, and TIFIA loans.

Some key developments in the P3 market in 2016:

- Colorado issued a Record of Decision for its $1.2B I-70 project. The contractor will be selected in summer 2017, and construction is estimated to begin in 2018.
- Virginia currently is undergoing construction on five projects valued at $7 billion. Additionally, three projects valued at $2.8 billion are under development and procurement in the Northern Virginia and Fredericksburg regions, including transforming I-66 outside the Beltway and extending the 95 Express Lanes to the north and south.
- Florida currently has the I-395 design-build-finance P3 project under procurement in Miami.
- Construction is underway on Florida's $2.9 billion I-4 Ultimate project, which is estimated to be completed in 2021.
- Ohio's first P3 project, the $634 million Portsmouth Bypass (also known as the Southern Ohio Veterans Memorial Highway), began construction in 2015. It is the largest single construction project in ODOT history. Another upcoming P3 project in Ohio is the $2.6 billion reconstruction of the Brent Spence Bridge between Ohio and Kentucky.
- Construction is underway on Pennsylvania's $899 million Rapid Bridge Replacement project. This project is expected to be completed in 2017, at which time 558 aging bridges will have been replaced in three years.
- The District of Columbia passed enabling P3 legislation in December 2014, and then created the Office of Public-Private Partnerships (DC OP3) in November 2015. Currently, the District of Columbia is exploring the use of P3 delivery for highway and street lighting projects.
- In June 2016, construction began on New York's $4 billion "unified" terminal at LaGuardia airport. The last phase of the project is expected to be complete in 2021.
- FHWA received 12 letters of interest for TIFIA in fiscal year 2014, for a total of $9.9 billion in projects, 12 letters of interest in fiscal year 2015, for a total of $14.3 billion in projects, and 10 letters of interest in fiscal year 2016, for a total of $10.7 billion in projects.
Challenges Facing the P3 Market: Another concern for states interested in pursuing P3 projects is funding availability at the state and federal level. As states are having increasing difficulty programming funding for new projects due to federal funding uncertainty, they are less able to provide the new commitments necessary for mega-P3 projects that are funded with availability payments.

A number of state DOTs are concerned about losing technical experience with P3 projects as staff retire or go to the private sector (the “brain drain”). This has prompted the formation of offices that focus primarily on P3 project delivery in some DOTs, like Virginia, Texas and Florida, in order to preserve this institutional knowledge with a dedicated staff that can navigate the complexities of P3 project agreements.

There has been an uptick in P3 projects outside the highway and bridge market, including light rail, passenger rail, ports and airports. The Los Angeles County Metropolitan Transportation Authority (Metro) in California established a P3 program to accelerate delivery of transportation projects. The November 2016 passage of Measure M in Los Angeles County is expected to raise $120 billion over 40 years, or $860 million annually, to fund Los Angeles Metro’s large project pipeline of rail and transit projects.

A recent trend in P3 projects has been increased use of availability payments, in which the public project sponsor makes payments to the private concessionaire based on project milestones or facility performance standards. Availability payments are generally used for tolled projects that are not expected to generate sufficient revenues for the private company to pay for construction and operation. Though availability payments lower finance costs, some states are hesitant about putting availability payments on their books as debt. One recent P3 project procured with availability payments is the $899 million Rapid Bridge Replacement project in Pennsylvania. The $2.1 billion F-M Area Diversion Project flood diversion channel in North Dakota and the $1.2 billion I-70 East project in Denver, Colorado will likely be funded using availability payments.

- Five highway-related P3 projects came to financial close in 2016, totaling over $3.3 billion in investment.  
  - Loop 202 South Mountain Freeway, Phoenix, Arizona ($916 million)  
  - I-5 Freeway and SR 16, Tacoma, Washington ($122 million)  
  - I-285/SR 400 Improvements, Atlanta, Georgia ($458 million)  
  - SH 288 Toll Lanes, Houston, Harris County, Texas ($1.07 billion)  
  - Parallel Thimble Shoal Tunnel, Chesapeake Bay, Virginia ($756 million)

Other states are continuing to embrace P3s as a successful project delivery mechanism. There is an increased appetite for accelerating project delivery, as well as moving projects that have been stuck, included in a state’s budget but for which funding is unavailable. While this is encouraging, the P3 market will continue to expand gradually and cautiously as more states have discussions about the feasibility of P3 project delivery and enabling legislation.

A recent trend in P3 projects has been increased use of availability payments, in which the public project sponsor makes payments to the private concessionaire based on project milestones or facility performance standards. Availability payments are generally used for tolled projects that are not expected to generate sufficient revenues for the private company to pay for construction and operation. Though availability payments lower finance costs, some states are hesitant about putting availability payments on their books as debt. One recent P3 project procured with availability payments is the $899 million Rapid Bridge Replacement project in Pennsylvania. The $2.1 billion F-M Area Diversion Project flood diversion channel in North Dakota and the $1.2 billion I-70 East project in Denver, Colorado will likely be funded using availability payments.

59 Public Works Financing
61 State DOT representatives provided an outlook on their overall programs and consulting awards as part of the 2016 ARTBA Planning and Design Division meetings at the AASHTO regional meetings. Twenty seven states did not provide updates.
62 Colorado Department of Transportation
63 FHWA, I-4 Ultimate Improvement Project
64 Ohio Department of Transportation, Brent Spence Bridge Corridor, U.S. Department of Transportation
65 FHWA, The Pennsylvania Rapid Bridge Replacement Project
66 Public Works Financing, Curbed New York (June 14, 2016)
67 Public Works Financing
68 FHWA
The transportation construction market is regulated by various federal standards and rules, which can have a significant impact on the industry. Below are some key legislative developments that will likely impact the market over the next five years:

• **Standard on Confined Spaces in Construction:** The Occupational Safety and Health Administration (OSHA) final rule on Confined Spaces in Construction became effective Oct. 2, 2015. It includes several new provisions that address construction-specific hazards that require widespread changes to construction operations for many employers.

• **Silica Rulemaking:** OSHA recently released a comprehensive rule regulating exposure to silica, a component of many building materials such as sand, stone, rock, concrete, brick, block, and mortar. Among other things, the new rule reduces the permissible exposure limit to crystalline silica to half the current standard, with a requirement to begin certain preventative measures when exposures reach 25 percent of the current limit. ARTBA and other industry groups are suing OSHA to have the agency revisit this rule. If this silica rule implemented in 2017 as now mandated, it will have an immediate and significant impact on the industry, which will be felt in the summer of 2017. The court is just beginning to review briefs on various law suits regarding this rule. If not delayed or changed, the industry will feel an impact as early as spring 2017.

• **New Backing Regulations:** OSHA has released an advanced notice for new regulations on backing of vehicles. The Agency has scheduled a “Small Business Advocacy Review panel” or “SBREFA” review for late 2016 or early 2017. While it will be several years before these regulations would be completed, it is too soon to tell if this regulation could impact construction in the outer years of the forecast.

• **Recordkeeping Clarification Rulemaking:** In May 2016, OSHA issued a new regulation expanding an employer’s obligation to document each recordable injury and illness throughout the 5-year period employers are required to keep the records. This new rule requires employers in “high-hazard industries” (including transportation construction) to send OSHA injury and illness data to OSHA for posting on the agency’s website. The rule also promotes an employee’s right to report injuries and illnesses “without fear of retaliation,” and clarifies that an employer must have a reasonable procedure for reporting work-related injuries that does not discourage employees from reporting them. The new requirements took effect Aug. 10, 2016, with phased in data submissions beginning in 2017. Using data collected under the new rule, OSHA will create the largest publicly available data set on work injuries and illnesses. While the rule does not create new recordkeeping requirements, it does require that data on OSHA logs be sent to the agency.
• **OSHA and the Manual on Uniform Traffic Control Devices:** The Occupational Safety and Health Administration (OSHA) is looking to update its reference to FHWA’s Manual on Uniform Traffic Control Devices (MUTCD) under an effort entitled the Standards Improvement Project-Phase IV (SIP-IV). Through this project, OSHA is proposing revisions to Subpart G, including an update to the references to the MUTCD to the Nov. 4, 2009 MUTCD (“2009 Edition”), including Revision 1 dated May 2012 and Revision 2 dated May 2012. Updating the reference to the 2009 Edition MUTCD will eliminate confusion as to which edition employers must comply with, and will inform employers that compliance with DOT regulations will not conflict with outdated OSHA regulations.

The following proposed regulatory changes are facing litigation, so they may not take effect until all court challenges are over. It is unclear how long each challenge will take.

• **Climate Change Regulations:** The EPA has promulgated regulations that would create additional restrictions for the coal-fired power generation industry, requiring existing plants to cut their carbon emissions. These regulations have currently been put on hold by a federal court as litigation unfolds. If they survive the court challenge, these regulations will likely lead to an increase in fuel prices, which will have an impact on the transportation construction industry.

• **Clean Water Act “Waters of the U.S.” Definition:** The “Waters of the U.S.” definition could classify roadside ditches as “waters of the U.S.” If roadside ditches are classified as “waters of the U.S.”, this would lead to increased permit burdens and delays for highway and bridge contractors. This regulation has currently been stayed by a federal appeals court. Should the rule survive legal challenge, it will then be implemented by the United States Environmental Protection Agency and Army Corps of Engineers.

• **Clean Air Act Ozone/PM Standards:** The ozone/PM standards of the Clean Air Act would increase restrictions for ozone and particulate matter levels. The EPA is required to review the standards every five years. The ozone standard was recently lowered, but is being challenged in federal court. Lowering of any standards for pollutants monitored under the Clean Air Act could put counties in non-attainment, restricting their ability to spend federal highway funds.
DEVELOPMENTS IN STATE AND LOCAL FUNDING

States, counties, cities in towns continued to invest new revenue for roads, bridges, ports and transit in 2016. Total anticipated revenue approved in 2016—both ballot and legislation—is an estimated $227.7 billion.

Thirty-eight states introduced over 90 transportation funding initiatives in 2016. Of those states, 15 successfully passed 17 measures, generating an estimated $20 billion to support transportation investment.

New Jersey Gov. Chris Christie (R) signed into law on Oct. 14, legislation to provide $16 billion in new state transportation funding over the next eight years. The 23 cents-per-gallon gas tax increase and 27 cents-per-gallon diesel tax increase went into effect on Nov. 1. The governor also rescinded the July 8 executive order that halted all non-essential, state-funding transportation projects due to the pending insolvency of the state’s transportation trust fund.

South Carolina Gov. Nikki Haley (R) on June 8 signed into law a bill to permanently dedicate Department of Motor Vehicle fees and fines to the State Highway Fund, as well as all revenues derived from state motor vehicle sales tax (currently only 50 percent is used for transportation purposes), to generate approximately $200 million per year for the state’s roads and bridges. The recurring revenue will be utilized to issue up to $2.2 billion in bonds for immediate use on transportation construction projects. Including existing revenue, the South Carolina Department of Transportation (SCDOT) anticipates accomplishing more than $4 billion of work over the next decade.

Voters in several states approved transportation measures on Nov. 8, including:

- A $100 million transportation construction bond in Maine and a $70 million port construction bond in Rhode Island;
- Lockbox measures that will dedicate all state motor fuel tax revenue for transportation purposes in New Jersey, and all transportation-related taxes, fees and bonds to transportation in Illinois;
- A 1-cent sales tax in Los Angeles that will provide $120 billion over 40 years for local road, bridge and transit projects; and
- A 25-year, $54 billion revenue package in Washington state that would support expanding Sound Transit light rail and bus routes. The package included a bond issue and adjustments in property, sales and motor vehicle taxes.

In addition to these ballot measures, the “Transportation Investment Advocacy Center”™ tracked 360 highway, bridge and transportation revenue-related initiatives up for vote by states, counties, or localities throughout 2016. Of this record number of transportation investment ballot measures, 267 measures were approved by voters, constituting 74 percent of all transportation funding measures up for consideration this year. Twenty-eight measures were requests for infrastructure bonds, with 25 approved by voters. Sixty-nine measures were to increase the state or local sales or income tax for transportation funding, with 42 passed. Two hundred and twelve measures asked voters to decide on a property tax increase, of which 181 were approved. Additionally, 29 county and local districts put a motor fuel increase on the ballot, of which voters approved 3. Including approved statewide measures, the total estimated value of these ballot measures is $207 billion.
2016 State Transportation Funding Legislation

Source: ARTBA’s Transportation Investment Advocacy Center Nov. 2016 State Funding Initiatives Report

*Indicates multiple bills in varying stages.
The ARTBA forecast is based on a series of proprietary econometric models for each mode and analysis of federal, state and local data and market intelligence. The ARTBA Economics & Research team, led by Dr. Alison Premo Black, has more than 40 years of combined experience analyzing the transportation construction market. ARTBA has conducted over 80 studies examining trends in national, state and local markets.

Each model is carefully evaluated and updated each year, based on new information and data sources.

For more information or details, please contact Dr. Alison Premo Black, ARTBA Senior Vice President, Policy & Chief Economist at ablack@artba.org or 202-289-4434.

As an example of how closely our forecast model tracks with the market, the graph below shows the relationship between the actual values of highway, street and bridge construction (in 2016$) compared to the fitted values of the model.

**Real value of public highway, streets, bridges and related construction, ARTBA forecast model vs. actual values**

Source: ARTBA forecast model. Measuring U.S. Census Bureau Value of Construction Put in Place for highways, streets and pavements. Nominal values have been deflated with the ARTBA Price Index, which takes into account material prices, project costs, general inflation and industry wages.