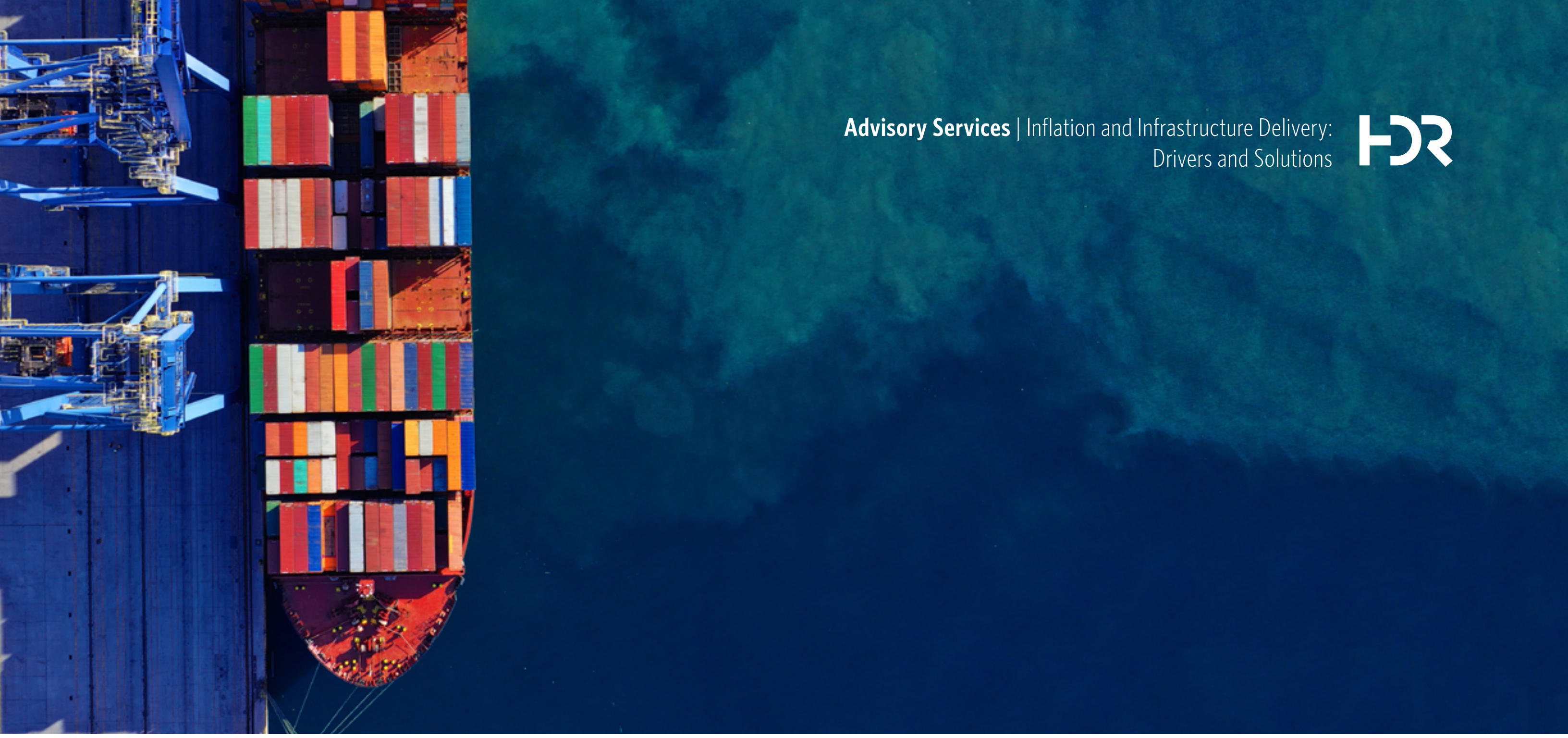


November 2022

Inflation and Infrastructure Delivery: Drivers and Solutions

INTRODUCTION

News about inflation seems to be everywhere. In June 2022, U.S. consumer inflation reached an annual rate of 9.1%. So, what does this mean for infrastructure owners and operators? Following a long period of low inflation, owners and operators are challenged to deliver infrastructure on time and on budget. Inflation affects the prices of commodities and labor, and recent supply chain issues coupled with high demand can make materials hard to obtain. What is driving this higher inflationary environment, and what can infrastructure owners and operators do to manage the challenges it presents?

In this paper, HDR experts share their views on inflation and how it affects the delivery of infrastructure projects. We review what inflation is and how it impacts delivery. We also discuss the drivers of inflation and provide an outlook for inflation in the short and longer term. Finally, we share some potential solutions for how to mitigate inflationary pressures in infrastructure delivery.

WHAT IS INFLATION?

Inflation is an increase in the general level of market prices. A little inflation is good. In fact, the U.S. Federal Reserve (the Fed) targets a low level of inflation – about 2% per year. A higher rate of inflation reflects a mismatch between supply and demand. This can be due to either demand outpacing supply, or a supply-side shock in which commodity and labor availability does not meet demand.

Inflationary pressures are different from the escalation normally associated with construction costs. There are many reasons for general increases in the cost of construction over time, including changes in technology or increased project complexity. Inflation reflects price increases associated with specific items such as concrete, steel, or labor. It may be one part of cost escalation, but it is not the only factor.

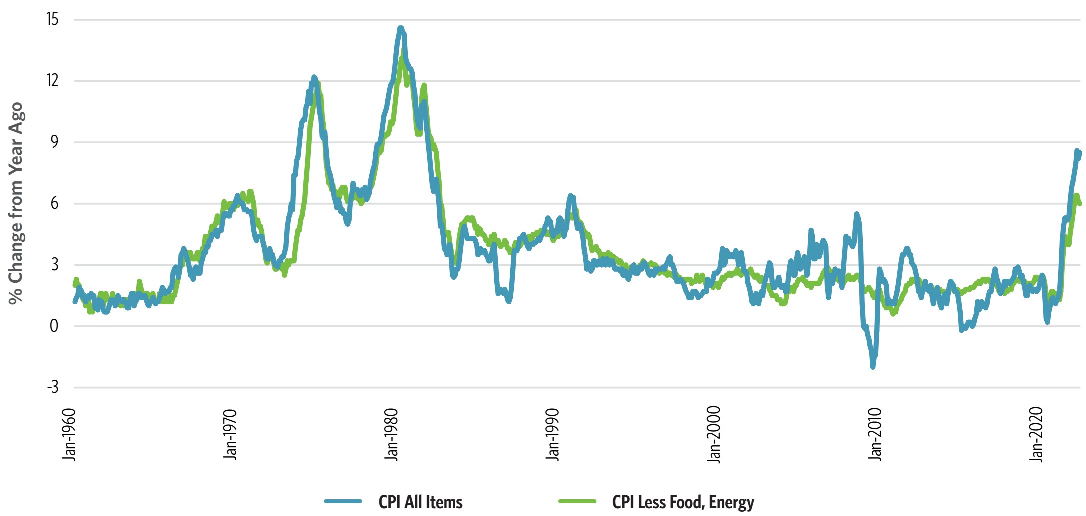
In a normally operating open market, rising prices encourage new suppliers to enter the market, facilitating supply to meet demand. In a highly inflationary environment, the introduction of new suppliers is not occurring. Recently, several news reports have documented how supply chain disruptions and geopolitical concerns have exacerbated the issue. While these are important factors in the current inflationary environment, there are others.

Many decision makers are concerned about the high inflation numbers. However, the underlying causes of inflation are a better guide for how to move forward. Instead, decision makers should focus on the factors that can assist agency business objectives during these uncertain times.

THE PROBLEM

Consumer Response. The United States is currently experiencing its highest rate of inflation since the early 1980s. Even though our current inflation is not unprecedented, much of the adult population is not old enough to remember the last round of high inflation. The lack of direct experience and historical context may make the Fed's charge to bring inflation down to its 2% target even more difficult. Consumer sentiment about the expected duration of inflation often has self-fulfilling impacts. If people believe high inflation will continue, then they will spend money now to avoid paying higher prices in the future. This increases near-term demand, further strains the market, and drives prices even higher. Moreover, employees will demand higher wages to keep up with rising prices, which will fuel further inflation. However, if people believe the government will lower inflation in a reasonably short timeframe, then they will not accelerate purchases.

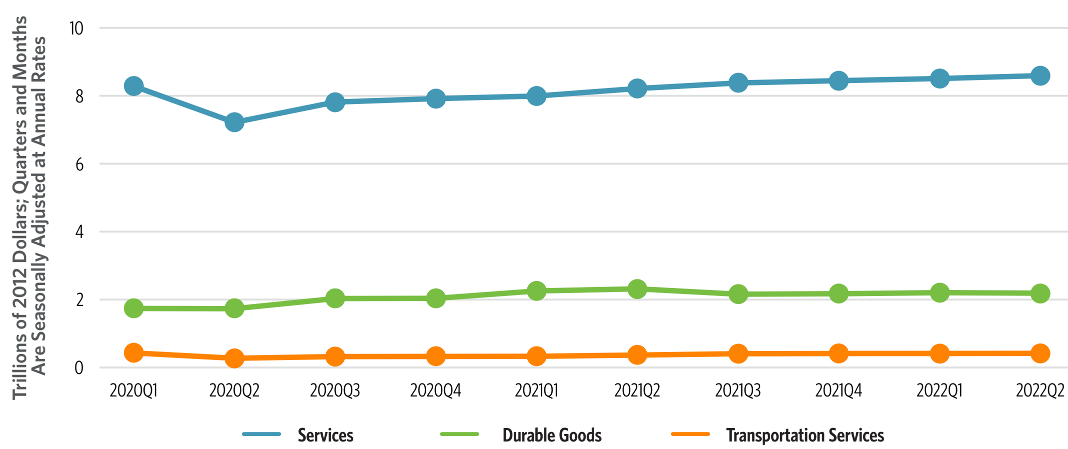
U.S. Consumer Price Index - 1960 to Present



Source: U.S. Bureau of Labor Statistics

Key Areas. Inflation has not dampened consumer demand yet. Even with most economies opening over the last year, the sales of goods are strong along with an increase in demand for services such as travel[1].

Real Personal Consumption Expenditures by Type of Product, 2012 Dollars



Source: U.S. Bureau of Economic Analysis

1 https://apps.bea.gov/iTable/iTable.cfm?ReqID=19&step=2#reqid=19&step=2&isuri=1&1921=underlying

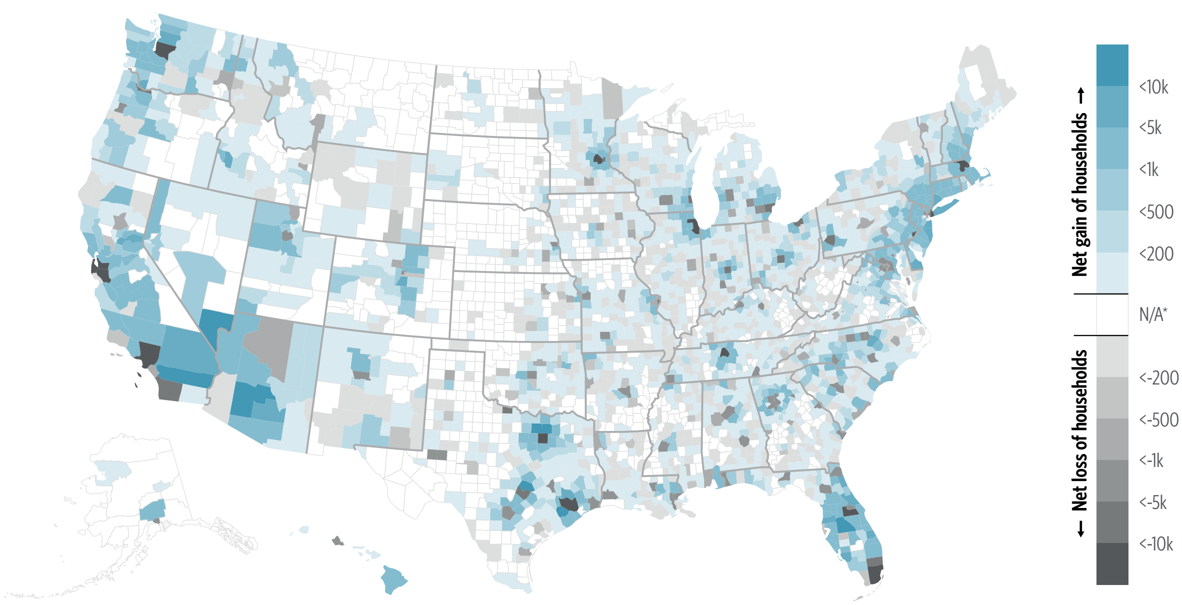
This does not mean inflation is being driven by just a few sectors. Demand for all types of travel is picking up, which increases demand, and therefore prices, for gasoline and diesel at a time when crude oil supply is in flux largely due to sanctions on Russia. Vehicle production is still not back to pre-pandemic levels, and the forecast for the rest of 2022 is not positive[2]. In addition, manufacturing delays are not limited to passenger vehicles. Heavy equipment fleets are also experiencing delays with manufacturing and shipping[3]. Supply-side shocks to items used across many sectors, including construction, are being compounded by an increasingly tight labor market. In the U.S., the national unemployment rate was 3.6% in June 2022[4], nearly a 50-year low.

Abrupt Changes. The demand for construction materials has grown with the demand for residential construction. With the rapid relocation of white-collar workers among states and from dense urban offices to working from home, many have chosen to leave big cities for smaller towns. As a result, the demand for single-family residential units has risen in areas far from established employment centers, while the demand for urban office space has declined. This, in turn, has increased the competition for materials such as lumber and concrete, disrupted supply chains by moving demand geographically, and caused massive shifts in the demand for construction[5].

Additional Demand. In addition, the Infrastructure Investment and Jobs Act (IIJA) will provide more than $500 billion in new spending on the nation's infrastructure over the next five years, including $78 billion in new funding programs[6]. While this spending will be spread across the country and over several years, it represents a significant increase in the demand for items already experiencing rapid cost increases. Regulations specifying the timeline for the spending may lead to sustained price pressure. The Buy America Act requirements also create supply-side constraints since any mechanism that limits the sourcing of materials will increase prices to some degree. At this point, many agencies, including the U.S. Department of Transportation[7], have held off enforcement of Buy America. Those waivers are scheduled to end in November 2022, with some exceptions.

A Global Problem. The interconnectedness of the global economy means virtually every country is being impacted by inflation. In the United Kingdom, inflation rose 8.2% in the 12 months to June 2022[8]. In the Euro area, inflation was 8.6% as of June 2022[9]. However, it is not just manufacturing and construction materials that are experiencing price volatility and contributing to inflation. In many countries around the world, volatility in the supply of wheat, oil, and natural gas have led to price increases in these commodities becoming key drivers of inflation. The war

Americans Moved During the Pandemic. Here's Where They Went.



Source: The Wall Street Journal

*Insufficient data or counties with a net change of zero

2 https://ihsmarkit.com/research-analysis/latest-global-automotive-forecast-changes.html
3 https://www.enr.com/articles/52545-2021-3q-cost-report-aging-iron-delivery-delays-seen-in-heavy-equipment-fleets
4 https://www.bls.gov/news.release/pdf/empsit.pdf
5 https://www.wsj.com/articles/americans-up-and-moved-during-the-pandemic-heres-where-they-went-11620734566
6 GuideBookDataset_Final published by the White House. Sum of all funding amounts where the New Program Column shows "yes".
7 https://www.transportation.gov/regulations/temporary-waiver-buy-america-requirements-construction-materials
8 https://www.ons.gov.uk/economy/inflationandpriceindices/bulletins/consumerpriceinflation/june2022
9 https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Inflation_in_the_euro_area

in Ukraine and subsequent sanctions placed on Russia are the leading cause for price volatility in the energy and agricultural sectors, but they are only one of many causes for the current levels of inflation. However, inflation spikes with these items in particular are a source of concern with regard to political stability around the world[10]. History has shown that high inflation on items like fuel and wheat increases citizens' unhappiness with their governments, leading to rioting and overall economic turmoil.

THE CAUSES

The underlying causes for the current inflationary period can be classified as contextual or structural. Contextual causes are those related directly to current world affairs, such as the COVID-19 pandemic and the war in Ukraine. Structural causes are related to established market trends, such as gradual changes in demographics and interest rates. While markets are expected to return to "normal" at some point, we should be aware that contextual causes can become structural factors as it may take longer for markets to adjust.

Consumption Changes. In spring 2020, there was a sudden increase in demand for goods like electronics, furniture, and sports equipment when everyone started spending a lot more time at home. With worker illness, increased demand for imports, and container shipping bottlenecks, global supply chains have not been able to keep up with the sudden increase in demand. There have also been overall labor shortages in industries like travel and restaurants, combined with an increased demand for in-person activities. Geopolitical events have also disrupted supply. With Ukraine unable to export and Russia limited by sanctions, there has been a dramatic drop in the supply of key commodities.

Interest Rates. The Fed lowered rates almost 15 years ago in response to the Great Recession and did not raise them until 2016. In Europe, interest rates were negative for almost 10 years. Prolonged low interest rates and slow growth led to structural changes in how economies operate, including increased appetite for risk to achieve higher rates of return and higher concentration in assets like real estate with consistent, above average, growth rates. It also lowered the cost of borrowing for purchases such as new equipment or technology updates.

Demographic Shifts in the labor pool are another structural change. Many workers chose to retire early due to the pandemic. For example, airline pilots were offered generous severance packages when travel dropped drastically in spring 2020. After a lull in airline travel, pilots are again in high demand, but the lack of replacements for the retiring pilots has led to a market-wide shortage. While there was also a drop in immigration due to border closures and travel restrictions, immigration had been slowing for several years. Many markets like construction and farming have an over-representation of immigrant labor compared to the overall pool, which makes them especially vulnerable to changes in immigration policies.

New Career Pathways is another structural trend impacting construction. There has been a gradual, long-term shift away from trades and toward jobs requiring college degrees. The Great Recession led to a drop in demand for skilled trade labor and supply has been slow to recover. This resulted in a smaller pool of experienced trade labor than expected, which is unable to cope with the dramatic uptick in demand that started two years ago.

CURRENT OUTLOOK

Easing of Supply Chain Pressures. In June 2021, the White House announced the creation of a Supply Chain Disruptions Task Force to work with government agencies, port authorities, rail, trucking and other stakeholders to address supply chain challenges resulting from the pandemic and speed up the movement of goods[11]. Among other things, the task force has launched a trucking action plan to recruit and retain more drivers, funded pop-up container facilities at ports, and launched a data sharing effort – Freight Logistics Optimization Works (FLOW) – to reduce shipping costs.

After two years of tightness, there are signs that supply strains are easing. Ocean freight rates have been declining from record highs[12]. Many retailers have high inventories and are more cautious about future orders of goods. Also, U.S. businesses are less exposed to supply challenges brought about by the war in Ukraine and the sanctions imposed on commodities involving Russia than European businesses are.

10 https://www.atlanticcouncil.org/blogs/econographics/putins-invasion-of-ukraine-could-spark-a-global-food-crisis/

11 The White House, Building Resilient Supply Chains, Revitalizing American Manufacturing, and Fostering Broad-Based Growth, June 2021. Available at: https://www.whitehouse.gov/wp-content/uploads/2021/06/100-day-supply-chain-review-report.pdf

12 Wall Street Journal, *Freight Rates Are Starting to Fall as Shipping Demand Wavers*, July 10, 2022. Available at: https://www.wsj.com/articles/freight-rates-are-starting-to-fall-as-shipping-demand-wavers-11657454400?reflink=desktopwebshare_permalink

Monetary Tightening. At the end of last year, the Fed announced a shift in the monetary policy, in view of elevated rates of inflation. First, the Fed cut down the monthly pace of purchases of Treasury securities and agency mortgage-backed securities. These purchases, dubbed "quantitative easing," were initiated in 2020 to support the flow of credit to households and businesses during the pandemic. The Fed later formalized its strategy to end quantitative easing[13]. Since June 2022, it has effectively been reducing its holdings of securities.

In parallel, the Fed has increased its target range for the federal funds rate[14] four times since March 2022, from 0.00-0.25% to 2.25-2.50%, its pre-pandemic level. It anticipates further rate hikes will be necessary this year to bring inflation down to its long-term goal of 2%. The Fed worries in particular that if people's expectations of future inflation escalate, it would be difficult to quickly achieve its 2% goal. According to the latest economic projections[15], the target range for the federal funds rate is expected to be 3.25-3.50% by the end of 2022, a level not seen since 2007.

Impact on U.S. Economy. The Fed's aggressive stance is meant to quickly bring down inflation. Making the cost of credit significantly higher has a dampening effect on demand from both households and businesses, which will lead to a slowdown and, in some industries, to a decline in prices. Economic activity as measured by the real gross domestic product decreased at an annual rate of 0.9% in the second quarter of 2022, following a decrease of 1.6% in the first quarter. Core inflation (inflation not including food and energy prices) has been trending downward since March. Headline inflation should begin to moderate in the second half of 2022 as commodity price increases slow, supply chain bottlenecks ease, and pent-up demand wanes. However, inflation rates will likely remain elevated next year before declining closer to pre-pandemic levels[16].

POTENTIAL SOLUTIONS

As inflation becomes more entrenched, delaying and re-prioritizing projects is no longer an adequate response. So, how can infrastructure owners hedge their risks?

Contract Terms. Material price adjustment clauses are occasionally included in contracts, especially for design-bid-build (DBB) projects. A 2019 AASHTO survey indicated that the majority of state departments of transportation (DOTs) used price adjustments for asphalt cement and fuel[17]. Steel price adjustments were also offered in 14 states. Respondents stated that the main benefits of price adjustment clauses are greater stability in the construction market and lower bid prices[18]. Other agencies have offered more robust cost escalation regimes that can provide relief over a wide array of commodities, labor, and equipment.

Adaptable Schedules and Specifications. Owners of infrastructure projects have multiple methods to control and reduce construction costs across the different phases of a project's life cycle[19]. A well-known method applicable during the early stages of planning and design is the use of adaptable specifications. Adaptable specifications

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13 Federal Reserve Board of Governors, *Principles for Reducing the Size of the Federal Reserve's Balance Sheet*, January 26, 2022. (federalreserve.gov)

Federal Reserve Board of Governors, *Plans for Reducing the Size of the Federal Reserve's Balance Sheet*, May 4, 2022. (federalreserve.gov)

14 The federal funds rate is the interest rate at which depository institutions lend reserve balances to other depository institutions overnight.

15 Federal Reserve Board of Governors, *Summary of Economic Projections*, June 15, 2022. (federalreserve.gov)

16 IHS Markit anticipates the U.S. construction industry to cool down starting in the second half of 2022 and continuing through 2024. The IHS Markit Non-residential Construction Cost Index is projected to grow by 0.2% in 2023 and to decline by 3.5% in 2024 (*Second Quarter 2022 Forecast*, June 3, 2022).

17 AASHTO Subcommittee on Construction, Contract Administration Section, *Survey on the Use of Price Adjustment Clauses for Inflation*, April 2019. (construction.transportation.org)

18 Texas A&M Transportation Institute, *Price Adjustment Clauses: Report*, Technical Report: 0-6799-1, June 2013. Available at: https://static.tti.tamu.edu/tti.tamu.edu/documents/0-6799-1.pdf

19 For example, see Evaluation of Ways and Procedures to Reduce Construction Cost and Increase Competition (tamu.edu)

can allow owners to reduce their exposure to price changes in materials stemming from uncertain market conditions while still maintaining the key characteristics and functionality of their projects.

Similarly, adaptable schedules allow owners to better manage price increases by sequencing project construction activities over a specified time (normally several years). In this way, they can maximize the long-term benefits of building a series of projects while abiding by budget. For example, HDR helped the Kingdom of Saudi Arabia develop a master plan for King Abdullah Economic City (KAEC) that explored adaptable schedules for the construction of different components of the city. Contractors can also benefit from flexibility in project delivery schedules. While researching the effects of California Senate Bill 1, HDR heard from industry leaders that schedules allowing for early delivery would help contractors better manage crew scheduling and control costs. In addition, many agencies reward contractors with incentives for time saved in project delivery.

Insurance Contracts. In response to the recent material price increases, some insurance companies are offering insurance contracts to provide more certainty to contractors. Under these policies, a contractor pays a monthly premium for the benefit of receiving an insurance payout if the contractor purchases a certain material or commodity when the spot price reaches a predetermined level. This type of insurance benefits most directly the subcontractors and material suppliers who purchase raw materials. However, owners and contractors can also benefit because they will be better positioned to honor the original pricing set in their contracts.

Project Grouping. Project grouping is another method used by infrastructure owners to control and reduce construction costs. This method has become popular in recent years for the rehabilitation and reconstruction of bridges in particular, as evidenced by the introduction of language in the 2022 Bridge Investment Program's Notice of Funding Opportunity related to the benefits of bridge grouping[20]. Agencies often group small bridge projects into a single design-build (DB) package or DBB package, if designs are already completed. The benefits of project grouping have been widely documented[21] and include expedited project delivery and reduced costs.

Under the current economic conditions, contractors may find groups of projects more attractive than individual projects, which can increase the number of bids for contracts. In addition, project grouping can allow contractors to reduce mobilization costs and leverage specialized crews (preparation work, foundation, substructure, etc.) across multiple projects if the projects are near each other. Working on several projects simultaneously and sharing standard specifications can help contractors achieve economies of scale[22]. As part of our work for the Iowa Council Bluffs Interstate System (CBIS), HDR found that grouping projects reduced the total cost of the program by approximately 15 percent.

Workforce Training. Over the last several years, there has been a shortage of people entering occupations related to infrastructure delivery. During our research on California Senate Bill 1, HDR heard from industry leaders about the difficulty in attracting young workers to construction jobs. The labor shortage includes occupations directly related to construction, such as cement masons and paving personnel, but it also includes truck drivers and other occupations related to the handling and delivery of materials. The American Trucking Associations estimated a nationwide shortage of 60,800 truck drivers at the end of 2018[23]. While the reduction in labor force supply is not the primary driver of the current inflation, it contributes to overall price increases for infrastructure projects. Some agencies are acting to address the workforce shortage. For example, the Federal Transit Administration has funded a Transit Workforce Center to develop the workforce needed to run public transit[24]. Workforce training programs may not completely offset current demographic changes, but they are long-term solutions that can reduce the inflationary pressures of limited labor supply.

Technology. Technological innovations are expected to have a wider and more enduring impact on the construction industry. The automation of physical tasks (e.g., robotic drywall installation and brick laying), design processes (through the application of machine learning techniques, in particular), 3D printing, and planning activities offers promising opportunities[25]. The use of drones, building information modeling (BIM) systems, and light detection and ranging (LiDAR) products[26] means that more data can be collected, processed, and analyzed faster and better, thereby improving the quality and accuracy of the information and reducing delays and costs. These innovations are also expected to generate notable productivity and safety gains. However, they can take time to implement and may not bring down costs in the short term.

20 View Opportunity | (grants.gov)

21 For examples, see Project Bundling Factsheet (dot.gov) and Bridge Bundling Guidebook (dot.gov)

22 Adaptable specifications can also be combined with project grouping to achieve economies of scale.

23 Labor and Workforce Development (trucking.org)

24 Workforce Development Initiative | FTA (dot.gov)

25 McKinsey & Company, *The Impact and Opportunities of Automation in Construction*, December 1, 2019. (mckinsey.com)

26 For instance, see: https://www.hdrinc.com/insights/unprecedented-access-unmanned-aerial-systems

Cost Monitoring and Management. HDR provides cost management services to help owners reduce uncertainty and better control costs. At the project level, we have applied its proprietary Cost Risk Analysis and Value Engineering (CRAVE™) process to hundreds of infrastructure projects in North America for nearly two decades[27]. This process not only assesses uncertainties in quantities and unit prices and quantifies risk events (e.g., geotechnical issues) with respect to schedule and cost, but it also identifies and evaluates opportunities by assessing possible alternatives and solutions. This integrated process allows for an investigative evaluation of proposed design against performance criteria, a validation of cost estimates and schedule, a comprehensive assessment of risks, and the development of recommendations based on risk analysis and value engineering.

At the program level, HDR has helped transportation agencies monitor or benchmark construction costs[28]. We have used historical bid data to create construction cost indices that track price fluctuations at the state level over time. More importantly, we have developed expertise in analyzing the factors affecting construction costs, such as changes in national, regional, and industry construction spending; seasonal changes in material prices; pressures on local labor market or materials markets; and trade policies such as tariffs or quotas. By including these market conditions in the forecasting of construction cost indices, we have helped clients improve the accuracy of their cost forecasting by accounting for region-specific variables that are ignored by traditional approaches to construction cost index forecasting.

Our experts are ready to help you as you chart your way through these uncertain times.

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President Biden recently signed H.R. 5376, commonly referred to as the Inflation Reduction Act of 2022. This paper does not consider the effects of the law on inflation related to infrastructure project development. The new law will be the subject of a future HDR Advisory Services policy brief.

27 See how HDR successfully applied its CRAVE process for the Minnesota DOT: https://www.hdrinc.com/portfolio/minnesota-crave
28 For instance: Minnesota Department of Transportation, Highway Construction Costs and Cost Inflation Study, February 2018. (dot.state.mn.us)