



EXPERTS TALK

Cost Forecasting and Inflation Management with Sarah Henly-Thomas and Bruno Penet



Sarah Henly-Thomas



Bruno Penet

More Accurate Cost Forecasts Improve Project and Program Planning for Infrastructure Owners

Rapid cost increases are challenging transportation infrastructure owners and operators to deliver projects on time and on budget. A key to better planning requires understanding the “how” and “when” of cost strategy. Enhanced cost forecasting based on data-driven techniques can provide that understanding.

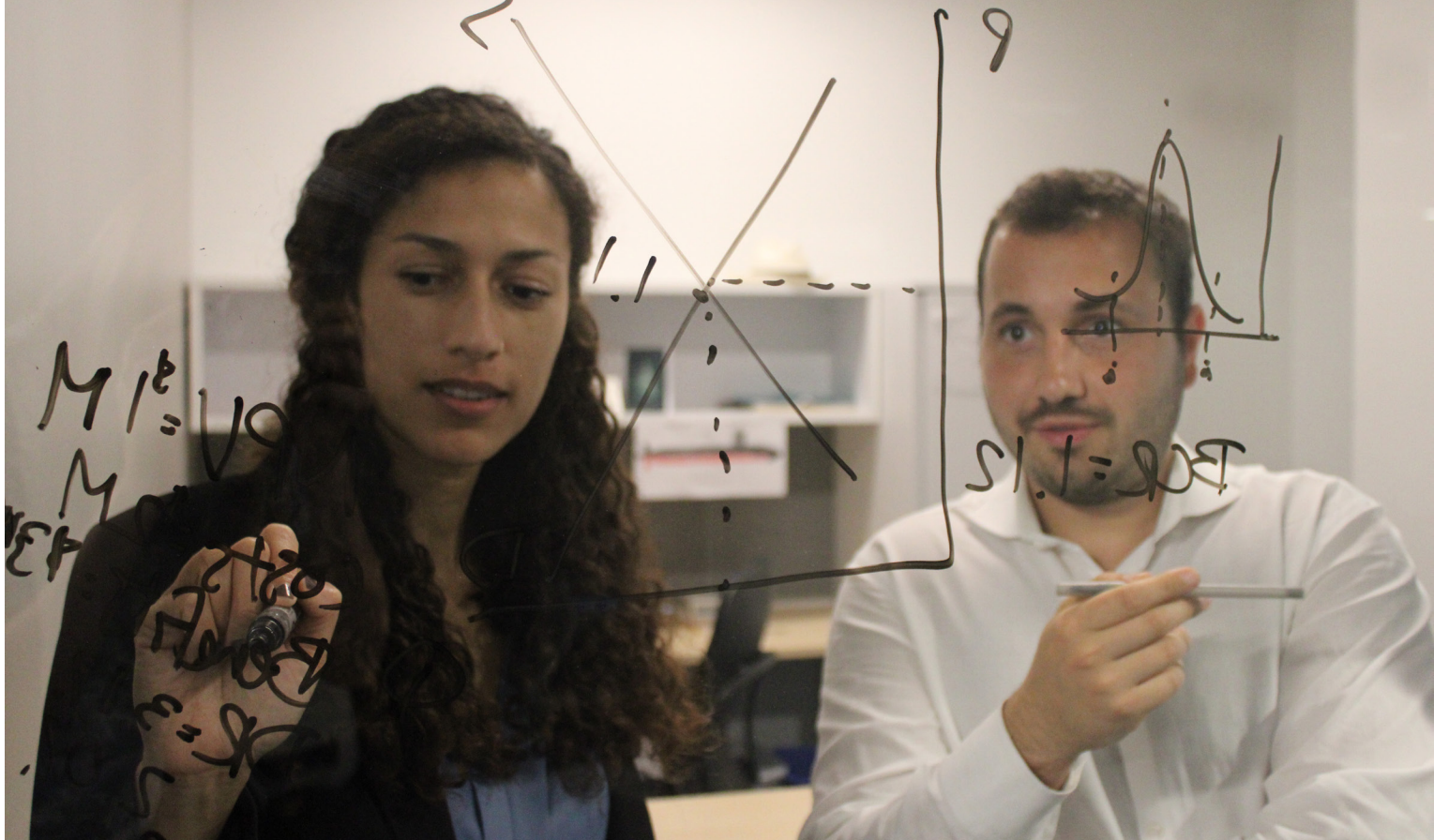
[Sarah Henly-Thomas](#) is HDR’s Mid-Atlantic Economics Lead and has helped agencies develop improved construction cost indices and cost escalation rates. Principal Economist [Bruno Penet](#) has more than 20 years of experience in the economic analysis of infrastructure projects in North America. He is an expert in demand/revenue forecasting and construction cost escalation for state governments. Both of them also provide cost forecasting expertise for individual projects as part of HDR’s risk analysis services.

In this interview, the two discuss why cost forecasting is particularly important in today’s economic climate, explain ways in which better data can offer more benefits than flat rate contingencies, and reflect on how advances in technology hold promise for enhanced forecasting in the future.

Q. Why do transportation agencies need cost forecasting services?

Penet: For our clients, it’s typically the same concerns across the industry: how can they balance revenues with costs? When the economy is in a recession, clients (state departments of transportation, in particular) tend to worry more about revenues; they want to make sure they will have enough money to fund all their capital projects in the coming years. On the other hand, when the economy is doing well and the construction and infrastructure industry is under pressure, their focus often shifts toward project costs. That’s precisely what has happened for the last four years.

HDR’s economics and statistics practice has a long history of assisting clients in managing capital project costs. Professionally, I have been providing cost forecasting services for as long as I have been working at HDR — 25 years now. For much of that time, during the Great Recession of the late 2000s and throughout the 2010s, inflation was low. But it all changed during the pandemic. Not only did inflation accelerate at a pace not seen since the global recession of the early 1980s, but the prices of many commodities — including construction materials — became unusually volatile. As a result, we have experienced an increase in the demand for cost forecasting services lately.



Q. Is cost forecasting meant to help capital projects or asset owner program portfolios?

Penet: Both. Cost escalation can cover a number of things, depending on whether we are focusing on the capital project level or the program portfolio level. Two notable areas of difference are the forecast horizon and the scope

For capital projects, the forecast horizon is typically less than 5 years. But for program portfolios, agencies are interested in long-term projections — 5 to 10 years into the future, if not more.

When it comes to scope, a single capital project can have literally hundreds of cost items if it's a large project or a very complex project. But a program, made up of many different projects, is even more complex.

At the program portfolio level, we help transportation agencies monitor or benchmark construction costs. We use 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 the local labor market or materials markets; and trade policies such as tariffs or quotas. By including these market factors in

the forecasting of construction cost indices, we help clients improve the accuracy of their cost forecast.

Q. Seems complicated. Wouldn't it be easier to just assume a flat rate of inflation on long-term programs?

Henly-Thomas: Many transportation infrastructure asset owners have been using either a consumer price index CPI or just a flat rate of inflation every year, basing future growth off historical growth. But as that has been particularly inaccurate lately, more transportation agencies and infrastructure owners have started seeking better methods to account for uncertainty.

We're working now with one department of transportation, for example, to update their historical cost index and then to produce forecasts from that index as well as semi-regular reports to present to the state legislature.

They had a construction cost index that was created internally by someone who was no longer with the DOT and other staff were unsure how to update it. We helped them improve their forecast methodology to use a standardized approach and modernize the index. We also created a dashboard to provide a visual representation of the forecast and historical results of the index. We're now helping the client update the index and model more regularly to produce better forecasts for the costs of their projects or programs.

Penet: When it comes to cost forecasting, there are three things involved:

- The direction that the price is going: Up, down or staying flat?
- The magnitude of the change: A 10% increase or a 0.5% increase?
- The timing of the change: When can we expect the trend to shift?

When agencies decide to simply use an annual growth rate of 4% for the next 10 years, they're missing all three of those items, because they're assuming that things are just going to be the same for the next decade, which is generally not a realistic way to forecast.

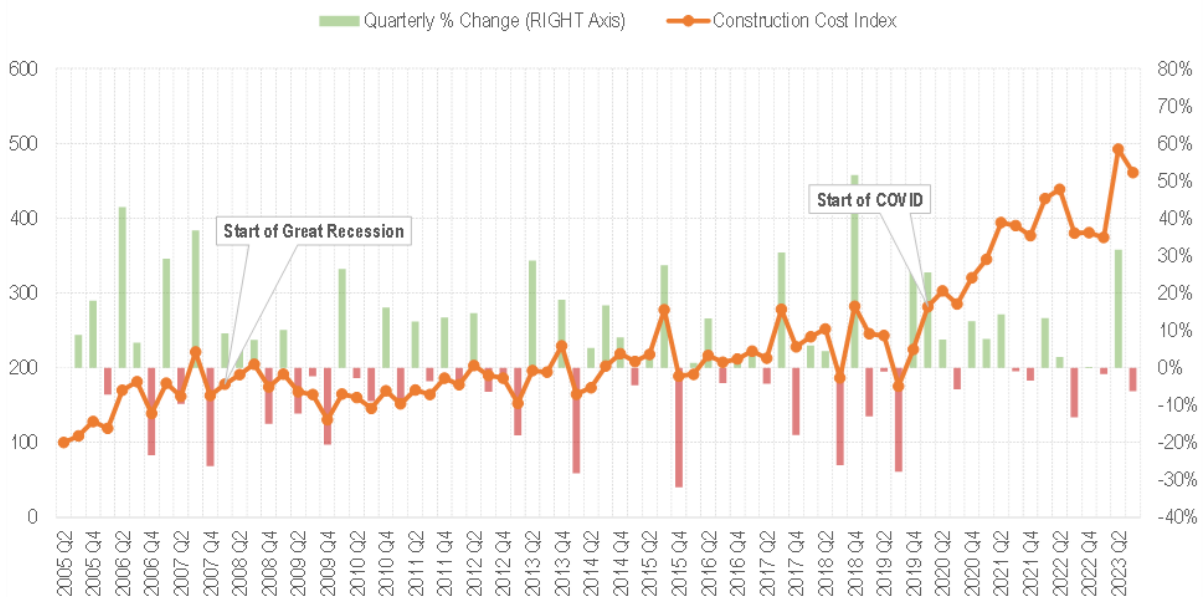
Q. How does inflation forecasting fit into the larger task of cost estimating for infrastructure capital projects?

Henly-Thomas: We help clients estimate costs for projects using multiple approaches to create a comprehensive view of project expenses. Our group has applied our proprietary Cost Risk Analysis and Value Engineering (CRAVE) process to hundreds of infrastructure projects in North America for nearly two decades. This process not only assesses uncertainties in quantities and unit prices and quantifies risk events (e.g., weather interruptions or permit delays) with respect to schedule and cost, but it also identifies and evaluates opportunities by assessing the effects of positive impacts (e.g., accelerated schedule or cost reduction).

To put it simply, we try to identify the risks and opportunities for a specific project. If project leaders are concerned that something may happen that could lead to schedule overruns, then we want to identify the type of cost that would be associated with that, make an educated guess about how long it would last, determine the cost implications and whether it would delay any other critical path items in the schedule. For example, if you're excavating, what's the risk associated with discovering unknown utilities and how would that affect the project cost and critical path? Or if there are ongoing supply chain delays because of global shipping challenges, what could the inflationary impacts be?

We start with a working session with engineers and project managers and everyone on the project team to identify the specific types of risks and opportunities that could occur. Together, we assign a monetary value to each of those potential risks and opportunities. And then we use risk analysis to determine the overall change to project cost based on the probability of each risk opportunity.

It's an iterative process. And at the end, we have a range of possible project costs that replaces the standard 20% contingency line item. The advantage is a better understanding of what makes up this contingency, and its potential range, which positions the project delivery team to proactively address and mitigate project risk.



HDR has been providing cost management services to the Utah Department of Transportation (UDOT) since 2022. HDR has developed a composite construction cost index using historical bid data. This quarterly index helps UDOT monitor construction costs at the program level over time.

Q. Isn't this simply a "spreadsheet exercise?" Why are specialized experts needed?

Penet: Cost forecasting can be especially complex for two main reasons:

First, construction costs are influenced by a variety of factors. These factors can be divided into two main categories: internal factors, over which clients exercise some control, and external factors, which are fundamentally beyond the control of clients.

Internal factors include the delivery method, scope creep, bias, and poor cost estimating. External factors, on the other hand, are numerous and extremely diverse:

- Supply chain considerations - are there bottlenecks?
- Labor market conditions - is the job market tight?
- Government spending - at the federal, state, and local levels
- Geopolitical context - international conflicts and tensions

Also, some factors may be specific to a region (wages, for example), while other factors may be national (such as interest rates) or global (e.g., oil prices). In the same way, some factors may be specific to the construction industry, while others may be prevalent throughout the economy

In addition, we need to account for uncertainty, which is inherent in forecasting. Uncertainty can arise from different sources:

- Incomplete information (sometimes there is no information available on a model variable)

- Measurement (data may be limited in size, scope, or accuracy)
- Computational modeling (no matter how sophisticated, models are always a simplification of reality)
- Unforeseen events (such as the COVID-19 pandemic)

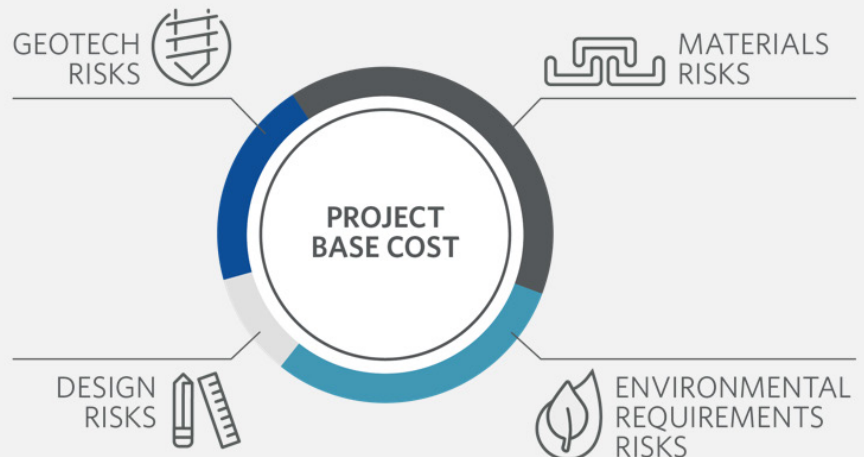
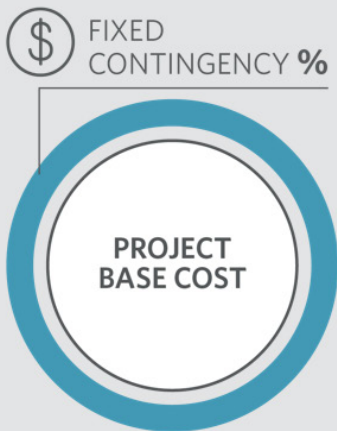
The result of all this is that many agencies need extra help to better predict the future costs of their projects and programs.

Henly-Thomas: It's important to understand that this sort of forecasting is not something you can do once and then hit an "easy button" and it'll automatically keep updating every three months. We're often asked if we can set something like that up, but it doesn't really work that way.

The short answer for why not: things are always changing. If we're developing a cost index, it's still a manual process. Every quarter there's a new batch of data. And then we have to use these data to figure out the value of the index for that quarter. All of the data has to be processed, cleaned, and classified into larger categories following the established methodologies. We have to identify and remove outliers and duplicates in the database. Every quarter we have to go through the same process.

And then we have to update the variables in our forecast, check the model fit and see if that's still accurate. In other words, it requires somebody trained in economics to review the changes every time to ensure they are still valid. It can be a lot of work. But worth it. Having this index provides agencies more information about what has driven unexpected costs in the past and ultimately can help them identify mitigation strategies going forward.

Traditional fixed contingency budgeting vs. a risk-based approach





We also use that information to build a forecast and help agencies develop a risk-weighted range of results for how those costs might change in the future. That can help infrastructure agencies with budgeting because they want to know how much funding to commit for projects in their program going forward without overcommitting funds that could be used on another project and without under committing funds and being stuck with overruns later.

Q. What's next in cost forecasting?

Penet: The general framework and techniques behind cost forecasting that we are using have been around for a long time. But the applications and software have evolved tremendously. They are much more sophisticated these days than they were 20 or even 10 years ago. This allows us to work faster and gives us more options when developing a forecast.

Lately, there's also been a lot of interest in AI. There have been attempts to apply AI approaches to cost forecasting. Two years ago, HDR participated in a study for the U.S. Army Corps of Engineers to explore ways machine learning techniques could improve the accuracy of their construction cost estimating process. The study led to the development of a conceptual model that combines both quantitative (machine learning) and qualitative (natural language processing) techniques.

Henly-Thomas: Artificial intelligence is certainly the next technological trend in cost forecasting, but one of the biggest changes we're seeing is simply the increased demand from clients for this expertise. More and more transportation agencies are becoming interested in using market-based forecasts rather than assuming a standard flat rate of inflation each year. The good news is that the economic tools are available to provide infrastructure agencies these more accurate and realistic forecasts.



Q. How did your career lead you to economics and cost forecasting?

Penet: I have been interested in economic issues since I was a teenager. To me, economics is a hybrid science, at the juncture of hard sciences (like mathematics) and soft sciences (like psychology). I like that it applies rigorous methods and techniques to explain (and predict) socio-economic phenomena.

Henly-Thomas: I've always been interested in applying quantitative methods as a way to help explain and understand the world. Economics provides tools to do this. Applying economic tools towards real-world situations is more exciting to me compared to straight theory. Supporting infrastructure development is also important for the world around us and makes me feel proud about the work my team and I do.

Q. Any advice for somebody interested in a similar career?

Penet: Sharpening your quantitative skills is critical as we use a lot of data and statistical techniques in our work. It can also help to have a 'detective' mind: we gather, process, review, analyze information from different sources in order to (correctly) understand and interpret economic trends and events.

Henly-Thomas: The basics are key: An economics degree, an interest in infrastructure and perhaps even an interest in community planning. But as the field grows and evolves, it could also be useful to develop a machine learning or computer science background. There's always room for people interested in developing innovative techniques to advance the practice.

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