Having written a book about traffic forecasting for banks, infrastructure funds and institutional investors, **Robert Bain** discusses some of his research and the track record of PPPs in the highways sector

Interviewed by Lloyd Fuller

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J ust back from finance conferences in Canada, Hong Kong and Malaysia, Rob Bain has certainly been racking up the air miles of late. The reason? His book, *Toll Road Traffic & Revenue Forecasts: An Interpreter's Guide*, has generated such considerable interest that he's been in demand to showcase his work in person. But why would investment professionals need a guide to traffic forecasts?

Bain left transport consultants Steer Davies Gleave back in 2001 and joined the credit rating agency Standard & Poor's. He spent the next five years with the agency, becoming a director in its Infrastructure Finance Ratings practice with specific responsibilities for transportation projects. Within minutes of the interview kicking off, he's talking about 'transaction structuring', 'collateral quality' and 'cash-flow volatility'. It sounds like a foreign language but things start to become clear pretty quickly.

"In many toll road deals the revenue forecasts represent the commercial proposition," he says. "This is the projected cash-flow stream that you are lending against – the economic value of the enterprise. And revenues derive from traffic forecasts. Yet these traffic forecasts and the techniques and assumptions underpinning them are frequently opaque to those charged with assessing credit quality and investment potential. I know because I often had to interpret them for colleagues in

financial services – hence the concept of an interpreter's guide."

Bain has researched traffic forecasting accuracy for many years and has published extensively on the subject. He was a traffic forecaster himself so knows models, modeling and how models work. "And how to make them work for you," he adds, acknowledging that forecasts can be manipulated as part of a well-crafted sales pitch to government agencies or candidate investors. This is a big money game, after all, with powerful vested interests and economic incentives at play.

Bias and error

"Sadly, parts of the transport profession remain in denial," Bain continues. "I remember reading an article a while back reporting the results from early research into optimism bias in road and rail forecasts. Some senior industry figures were quoted as saying systematic mistakes and deliberate misrepresentation did not occur. This goes

on all the time, either consciously or subconsciously. It's well documented. Look at the psychology literature on organizational pressure, attribution error and cognitive bias. There's a rich seam of material on accentuating the positive, downplaying the negative, and underestimating risk and uncertainty in many areas of forecasting. And that's before we consider specific commercial motivations for lying. In the book, I highlight this in the context of traffic forecasts, with research evidence in support."

Highlight these facts he certainly does. One of the chapters is provocatively entitled *21 ways to inflate traffic and revenue forecasts*! "That was fun to write, but it has a serious side to it," Bain says. "People can be seduced by some of the technical aspects of traffic modeling to the extent that they treat forecasts as gospel. In terms of bias, I simply demonstrate that it's perfectly possible to skew modeling outputs if required and I identify some of the danger signals to

watch for. The best way to teach people about this is to show them how it's done."

Reminding Bain that we all know that traffic models are imperfect, he interjects. "Remember that the primary audience for my book lies outside the transport profession. Over-emphasis on the technicalities of modeling is often used to provide pseudo-comfort to the recipients of traffic forecasts, to baffle them with science, infer spurious levels of accuracy and defend hopelessly narrow confidence intervals. However my interest lies more with the applied challenges of forecasting than with modeling per se. As an example, I saw a near-perfect model recently. It explained the growth in vehicle kilometers traveled in a European country in terms of past movements in GDP, fuel price and car ownership. A goodness of fit exceeding 98%. Perfect. But for forecasts we need future predictions of the explanatory variables themselves – GDP, fuel price and car ownership. We started with GDP, but the central bank could only give us GDP forecasts for the next five years. Our forecasting horizon was 30 years! So even with a perfect model the forecasting challenges remain significant – and most transport models are far from perfect."

Bain initially comes across as being hostile to his ex-colleagues in the traffic forecasting community, although as the interview progresses, you start to understand where he's coming from. At the rating agency he faced a succession of bankers – sometimes with their traffic

> "...What the European roads sector really needs in the long-term is a sensible funding solution – and that's road pricing"

consultants in tow – insisting that their forecasts could be believed to the extent that investment-grade ratings could be assigned to their projects. High credit ratings significantly reduce the cost of debt capital. And with large success fees at stake this insistence was often very assertive. This is the reality to which his book responds. So can transport modelers realistically improve traffic forecasting reliability to the satisfaction of private investors, beyond reliance on mere arguments of assertion?

"The issue needs to be attacked on a number of fronts," he responds. "For sure there are examples of good forecasting practice out there. Transparency, credible sensitivity testing and rigorous peer reviews rank highly. In concert we should be more realistic about uncertainly and the limitations of models. That would be a major step forward. However the important issue for me is the context within which traffic forecasts are set. Investor-financed road projects are highly structured and a number of them are aggressively financially engineered with little margin for error. All of the evidence suggests that this is

fundamentally wrong. Sustainable projects need flexibility to accommodate the inevitable departures from performance expectations that will occur over the typical contract period of 30 years or more. They should be able to survive the stresses of the full business cycle and periods when cash-flow volatility may be higher than usual. There's the real answer. Adult conversations about risk and uncertainty, and realistic deal structuring – not some fruitless search for the supposedly perfect forecast."
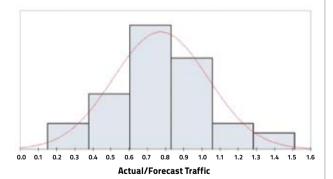
PPP roads

Talk of investor-financed roads broadens the interview from traffic forecasting to the bigger picture of PPPs and their role in the transport sector. Bain has witnessed public-private partnerships around the world from various perspectives – as a technical consultant, as a rating analyst, as an academic researcher and, most recently, reviewing lending exposure for commercial and development banks. So do PPP roads offer value for money for public sector contracting authorities?

"This was the focus for my PhD and, in terms of the traditional PPP model, the roads sector certainly has some appealing characteristics. What we're discussing are long-term, vertically integrated and relatively complete contracts that seek to optimize risk-sharing between the public and the private sectors. Roads are generally uncomplicated assets with construction technologies and risks that are widely understood. There are strong build-maintain synergies. These are good starts. The pace of development in the sector is gradual – important when you're locked into a 30-year contract. Similarly, the public policy context for roads is unlikely to change in the foreseeable future, perhaps with the exception of road pricing – and this eventuality can be accommodated contractually. Risk allocation is relatively straightforward and it's possible to carve out road projects in ways that make them separable operationally, economically and institutionally from other activities. This is key. They can be developed as clear standalone projects with limited interface risk or reliance on third parties. And as a result of the history of private sector road

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🐦 | Toll road traffic forecasting accuracy

While working for Standard & Poor's, Bain collated the traffic forecasts and outturn figures from over 100 separate toll roads, bridges and tunnels around the world. This was the largest comparative study of its type to have been conducted globally as this wealth of commercial-in-confidence data is seldom shared with parties outside the financial services sector. The chart summarizes his findings as ratios of actual-to-forecast traffic. A ratio above 1.0 means performance has exceeded the prediction (i.e. the forecast). The fitted distribution shown is, however, centred on 0.77 meaning that on average toll road traffic forecasts were

Actual/Forecast Traffic

over-optimistic by 20-25%. The range of forecasting error, denoted by the large standard deviation, is considerable. In some toll projects, traffic performance exceeded expectations by 50%. In others, outturn traffic was less than 20% of the

respective forecast. The full results from this research, the results from other smaller-scale comparative toll road forecasting studies from around the world – and their implications for investors – are described further in Bain's book.

construction and maintenance in many countries, road projects do not face the same barriers to perceived creeping privatization as say projects in the health and education sectors. Add all of those attributes up and you have a potentially winning formula.

"Incidentally", he adds, "if you map rail projects against many of the criteria I've just mentioned, you can start to understand why a number of international PPPs in that particular sector have found it more challenging to deliver value for money."

Bain's theories appear sound. But what of the evidence relating to value for money from PPP roads. During his PhD, he negotiated access to previously unreleased data from the UK Highways Agency that allowed him to recreate the public sector comparators for the first eight Design Build Finance and Operate (DBFO) shadow toll roads, so he understands the economic arguments well. "Two of the main criticisms leveled at the Agency's early DBFO roads were that the optimism-bias adjustments were overcooked and that the high discount rate inherently penalized the conventional procurement option. By reformulating the comparators in spreadsheets and changing key input assumptions, I showed that the early roads program continued to represent value for money with almost zero optimism-bias uplift and at today's test discount rate of 3.5%. The PFI procurement policy appears to have had a stronger justification than even the Highways Agency maintained. And, looking beyond the UK at some other reviews I've conducted for banks, it's clear that PPP roads generally meet their policy objectives in terms of on-time and within-budget asset delivery, and providing value for money for the public sector. But it's not all about buying insurance policies against over-budget and behind-schedule projects, and demonstrating economic worth."

Surely these issues are exactly what PPPs are all about? "Let's be very clear", Bain says. "We started by discussing traditional toll roads with point-of-use charging; we've now moved on to PPPs. PPPs can involve user charges or, as is often the case in the UK and elsewhere, a payment stream from government spread over the life of the contract based on measures of asset availability and service quality. These are very different animals. The former breaks the link between government support and infrastructure provision. The latter maintains that link and simply reprofiles the financial commitment over 25 or 30 years – with interest. My comments are directed at shadow toll, availability or performance-based road schemes. Evaluation of these PFI or PPP projects – whatever you call them – should not focus

solely on a comparison with public sector comparators. There is a real-world restriction that needs to be considered and that is the affordability constraint – although this is commonly, rather conveniently, overlooked."

Bain comes across as being very positive about private sector finance yet here he is issuing a stern caution. "Estimates suggest that between 35% and 40% of the Highways Agency budget is required to support its PFI roads portfolio, yet the roads themselves account for around 17% of the network. In the health sector, there have been rumblings about PFI hospital affordability at a couple of NHS Trusts for some time. Portugal developed an ambitious program of shadow toll motorways only to discover it couldn't service the aggregate payments. Now it's trying to move from shadow tolls to real tolls and renegotiate a number of concessions. In Spain, PPP debt-related commitments are starting to impact on public sector credit ratings. Some time back, Standard & Poor's assigned a negative outlook to the Autonomous Community of Madrid because servicing PPP debt accounts for 60-75% of its spending – severely constraining future expenditure flexibility. Commentators have labeled the phenomenon 'silting-up'. That's what happens when you buy infrastructure on the government's credit card without acknowledging the supply of funds is finite and incorporating the affordability constraint within the appraisal framework. The situation is thrown into sharp relief in a

Toll roads, bridges and tunnels represent the most popular class of infrastructure attracting international private finance today. Many deals, however, expose financiers, insurers and other project counterparties to demand risk

recession when the tax-take is reduced, and is exacerbated further if public spending starts getting squeezed to cut a sizeable national budget deficit. Add to that political statements about protecting health and education spend, and it casts commitment to long-term transport PPPs in an interesting light."

Weighing up the risks

Although a finance guy, Bain's comments repeatedly have been reflections on public policy. Is that really his primary focus? "Credit analysis looks across all project risks," he replies, "and political risk should never be overlooked in PPPs that rely on ongoing state support." So the solution is? "Road pricing and commercialization of the sector. Shadow toll, availability or performance-based road PPPs are a financing solution. They're a step in the right direction but what Europe's roads sector needs in the long-term is a sensible funding solution – and that's road pricing."

Bain leaves the interview heading for Leeds University's School of Civil Engineering where he lectures as a visiting research fellow. He's a firm believer that the engineers of tomorrow need to understand the basics of credit and the workings of the financial services sector. For engineers to make intelligent use of private finance, he says, you need finance-literate engineers. No doubt his lecture will be well received by his students. ○

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