STANDARD & POOR'S
INFRASTRUCTURE FINANCE

Publication date:Nov 06 2003
Reprinted from RatingsDirect

Traffic Forecasting Risk: Study Update 2003

Credit Analysts: Robert Bain, London (44) 20-7826-3520; Jan Willem Plantagie, Frankfurt (49) 69-3 39 99-132

Variability in traffic forecast performance is greater than earlier indications suggested, Standard & Poor's Ratings Services has concluded following an updated and extended study of the toll road sector. Traffic forecasts are central to the assessment of credit risk in most toll facility financings. In 2002, Standard & Poor's published the results of an international retrospective on toll road traffic forecasting performance. Over the last twelve months, Standard & Poor's has expanded its toll road forecasting case studies to 68 from the original sample of 32. Its key conclusions, however, remain largely unchanged. This article updates the original results and presents the conclusions of the 2003 study.

Optimism bias remains a consistent feature of toll road traffic forecasting. Although variability appears to be greater, it is in part country specific. Forecasts prepared for host jurisdictions with a history of tolling, although still optimistic on average, have a significantly smaller error distribution than those from countries new to road tolling.

Standard & Poor's research also looked behind the traffic figures to uncover some of the reasons for predictive failure. Key "error drivers", some of the principal sources of revenue risk, have been identified. Mitigation of these risks provides a basis for stronger credit quality.

The research reported in this article is ongoing. Standard & Poor's continues to explore, in detail, the credit dynamics of the evolving toll road sector. Comprehensive demand studies conducted by experienced and internationally recognized traffic consultants are a necessary, but not by themselves sufficient, prerequisite for investment-grade ratings. Standard & Poor's research focuses specifically on the interpretation of forecasts, such that lenders can make their own, informed decisions about future project performance, and the nature and extent of associated market risk.

A Retrospective Analysis

The business case for many project-financed toll road, bridge, and tunnel transactions relies heavily on projections of traffic and therefore revenue. This places market risk at the forefront of credit analysis. Market risk is commonly greatest at project opening, and so Standard & Poor's focused on the first year of operations. The research examined an international sample of toll facilities for which "before" and "after" data were available on a reliable and consistent basis. This allowed for a comparison of traffic forecasts with outturn results. The original report, "Credit Implications of Traffic Risk in Start-Up Toll Facilities", was published on RatingsDirect, Standard & Poor's Web-based credit analysis system, on August 15, 2002.

The original sample contained 32 global case studies reflecting different types of toll facility and different cost-recovery regimes. Data scarcity has been a challenge, but Standard & Poor's has continued to assemble toll road traffic figures and projections. Strict requirements that all data should be double-sourced and allow for valid comparison have constrained the growth of the initial sampling frame. At Oct. 31, 2003, however, the international toll road forecasting case studies have more than doubled to 68.

Updated Research Supports Earlier Conclusions

Analysis of the expanded data set supports Standard & Poor's earlier finding that optimism bias is a consistent trend in toll road traffic forecasting. The mean error, overprediction by about 25% in Year 1, is almost identical for the smaller 2002 and expanded 2003 samples. For comparison purposes, the distribution of results from both samples are presented in charts 1 and 2. Start-up forecast performance (i.e. performance one year after construction was completed) is measured through ratios of actual to predicted traffic volumes.

Chart 1

Standard & Poor's Original Sample (2002)
Normal (0.73, 0.22), *n* = 32

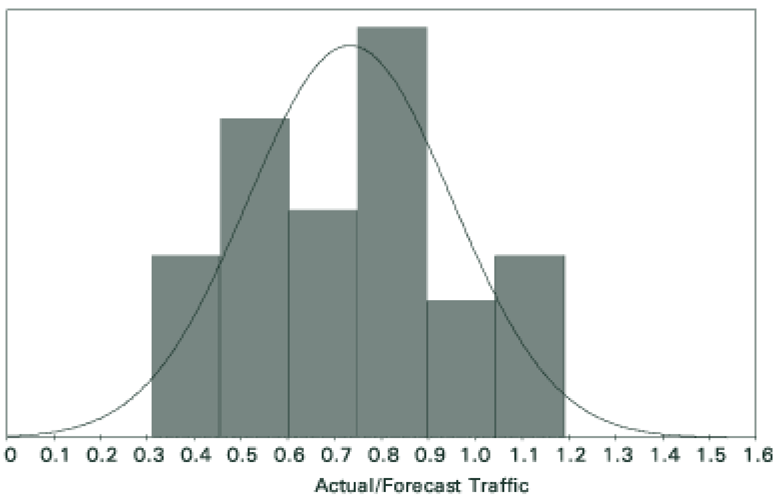
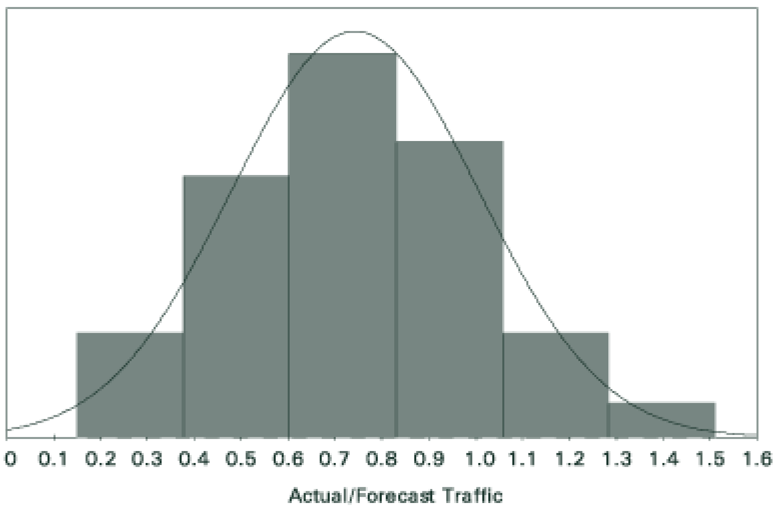


Chart 2

Standard & Poor's Expanded Sample (2003)
Normal (0.74, 0.26), *n* = 68



Curve-fitting software suggested a symmetrical distribution in both cases. The means for the original and expanded samples were almost identical (0.73 and 0.74 respectively, skewed to the left of unity, indicating forecast optimism). The standard deviation for the expanded sample, however, shows an 18% increase over that derived from the 2002 data set. This reflects the greater range of forecasting performance observed in the expanded sample. Summary statistics are provided in table 1.

Table 1 Actual to Forecast Traffic Ratio

(x)	2003 update	2002 study
Minimum	0.15	0.31
Maximum	1.51	1.19
Mean	0.74	0.73
Number of case studies	68	32

The increased standard deviation observed from the 2003 study update is significant. From a credit analysis perspective, it is of particular concern because it implies that the variability of forecasting performance is greater than earlier indications suggested.

The first study, in combination with Standard & Poor's long experience of analyzing international toll road facilities, also resulted in the development of an analytical tool, the Traffic Risk Index, that allows for the mapping of an individual toll facility's risk profile against key criteria in a consistent and comprehensive way. The aim of the Index is to assist with the interpretation of traffic forecasts to gauge just how much uncertainty may surround particular projections and guide the development and application of appropriate stress tests.

Disaggregate Analysis

The increase of the sample size to 68 from 32 is significant, not just in terms of providing enhanced confidence in earlier results, but also in terms of analytical opportunity. The larger information base permits more disaggregate data analysis.

Standard & Poor's approached its disaggregate analysis from a number of exploratory perspectives. The strongest results, however, were obtained from a separation of the data into countries with a history of toll facility development and use and those for whom road tolling was new. Charts 3 and 4 show the resulting subsample error distributions.

Chart 3

Host Jurisdicitions with a History of Tolling
Normal (0.81, 0.24)

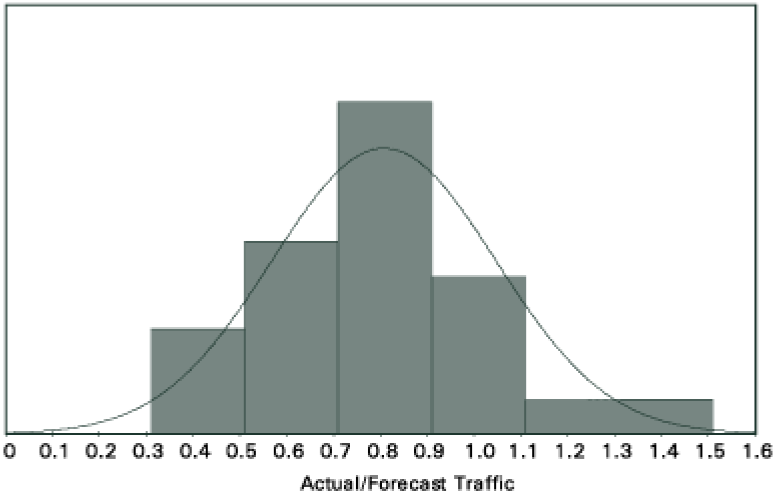
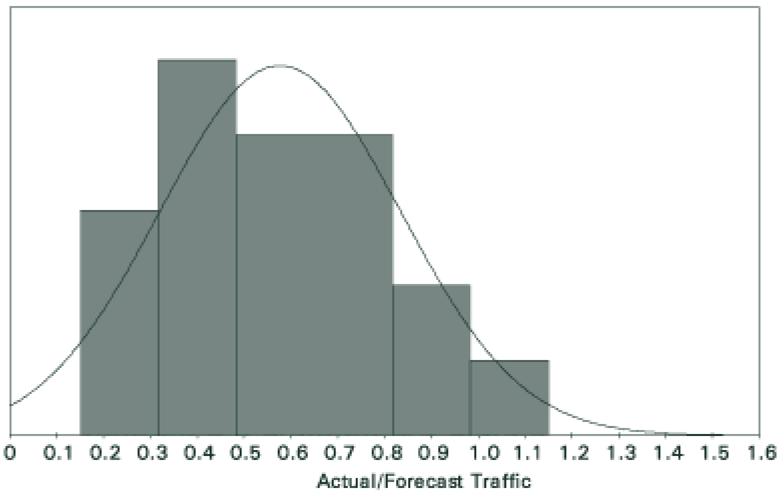


Chart 4

Host Jurisdictions with No History of Tolling
Normal (0.58, 0.26)



The disaggregation of the forecast performance data set into the two subsamples appears to be justified. The sample means (average errors of 19% and 42%) are significantly different, reflecting the fact that forecasting performance appears to be considerably poorer in those countries new to road tolling. In countries with a history of tolling, consumers can be observed making choices about route selection, effectively trading off the advantages against the costs of using tolled highway facilities. The consumer response can therefore be more readily understood by forecasters preparing predictions for new or extended facility use.

Gauging this consumer response is much more challenging in countries where tolling is new. There is no "revealed preference" consumer behavior to observe, which leaves forecasters more reliant on theoretical survey techniques and assumptions about how drivers may respond to tolls. In terms of working with and interpreting forecasts, this suggests that demand projections prepared in countries new to tolling should be subject to particular scrutiny and, circumstances dictating, more exacting stress testing. The Traffic Risk Index can be a guide in that context.

More Data, More Information

Much of Standard & Poor's toll road case study information was derived from annual operational or surveillance reports prepared for lenders. Typically, where these reports note a departure of actual traffic demand from projected volumes, an explanatory commentary is provided. These explanations were used, in part, during the 2002 study to derive the Traffic Risk Index.

The reasons attributed to failed forecasts--the error drivers--are highly significant in the context of credit analysis. They suggest a number of key attributes or indicators that must be considered during the analytical process. The error drivers are presented in table 2. No particular order of priority is inferred. Not all will be relevant in every context, but, because many of them were reported on different occasions for different facilities, it can be illuminating to explore how exposed to these major sources of future uncertainty individual toll road projects are. Projects demonstrating resilience against most or all of these drivers, or those for whom the error drivers remain less relevant, have stronger credit quality in terms of traffic risk. This strength, however, would only result in a higher rating if it were supported by credit enhancements in other key areas of a transaction's structure.

Table 2 Forecast Failure: Key Error Drivers

From the 2002 study	Additional drivers identified in the 2003 study update
High toll tariffs and a miscalculation of users' willingness to pay (especially frequent users such as commuters)	Complexity of the transaction (hence the traffic modeling challenge)
Recession/economic downturn	Underestimation of the severity and duration of ramp-up
Future land use scenarios that never transpired (including development build-out along corridors that was less and/or slower than predicted)	Underestimation of the value of time
Time savings that were lower than expected	Use of a single, average value of time rather than a distribution of values of time
Improvements to competitive (toll-free) routes	Longer-term traffic forecasts very sensitive to macroeconomic predictions, such as assumptions about GDP growth
Considerably lower usage by trucks	
Lower off-peak/weekend traffic	

Traffic Forecasting: Recent Developments and Resulting Credit Challenges

Complex tariff schedules and payment mechanisms.

Two trends, one affecting user-paid tolls and the other of more relevance to shadow toll offerings, lie behind the development of increasingly complex cost recovery regimes. For user-paid tolls, an industry trend toward the adoption of electronic toll collection technologies introduces the opportunity for sophisticated pricing with tariff differentials reflecting time-of-day, day-of-week, seasonal, and/or congestion-related criteria. Shadow toll payment mechanisms can rely on traffic volumes by section of road, by direction, and/or by the level of service enjoyed by patrons. Other variants exist for both shadow and user-paid tolls, but the concept is generic and the trend is strong. The implication for traffic forecasting is the need to prepare highly detailed and disaggregate forecasts ("microforecasting") so that individual components of a revenue stream can be pooled to reflect the projected gross income.

The need to prepare highly disaggregate projections compounds the challenge faced by the traffic demand forecaster. The response is to develop either a very detailed modeling framework, perhaps with multiple time slices and user classes, to introduce further layers of assumptions about detailed consumer behavior, or both. In any case, microforecasting has the potential to introduce uncertainties of its own into the predictive process and modeling output can become less transparent, adding complexity to the interpretation of results. Complex tariff structures and payment mechanisms may therefore themselves become constraints, capping the credit quality of toll road projects.

Probability models.
As the recipient of many traffic study reports, Standard & Poor's is aware of recent trends to cast toll road traffic and revenue forecasts within a probabilistic framework, which commonly employs Monte Carlo simulation techniques. Although any development that highlights the variability of future predictions is to be welcomed, many project uncertainties lie external to the traffic modeling environment. These uncertainties, therefore, may not be fully captured by within-model probability analysis. Resulting confidence levels or intervals could be misleading.

If credit analysis is to be detailed, critical, and rigorous, the output of any traffic model must be interpreted within the broadest possible understanding of a toll road transaction's structural risk profile and any associated credit enhancements.

Analyst E-Mail Addresses

robert_bain@standardandpoors.com
jan_plantagie@standardandpoors.com
InfrastructureEurope@standardandpoors.com