It's about time

The toll road sector is focusing on the wrong benchmarking metric of value for money, sending misleading signals to infrastructure investors, transport analysts Robert Bain and Sylvain Senechal argue

Benchmarks are used in infrastructure analysis as independent reference points when evaluating an investment strategy or a particular investment candidate. They can be financial – peer comparisons of EBITDA margins are commonplace – or focused on the sector-specific operational or performance aspects of assets. Over time, best practice emerges based on experience of the attributes and qualities that lead to positive investment outcomes (critical success factors).

In the toll road sector, benchmarks are used to shine a light on the attractiveness of a facility to consumers. In the context of traffic and revenue forecasting, they are commonly cited in support of the more ambitious predictions of demand. In short, they are used to signal value for money – and this has important and widespread implications:

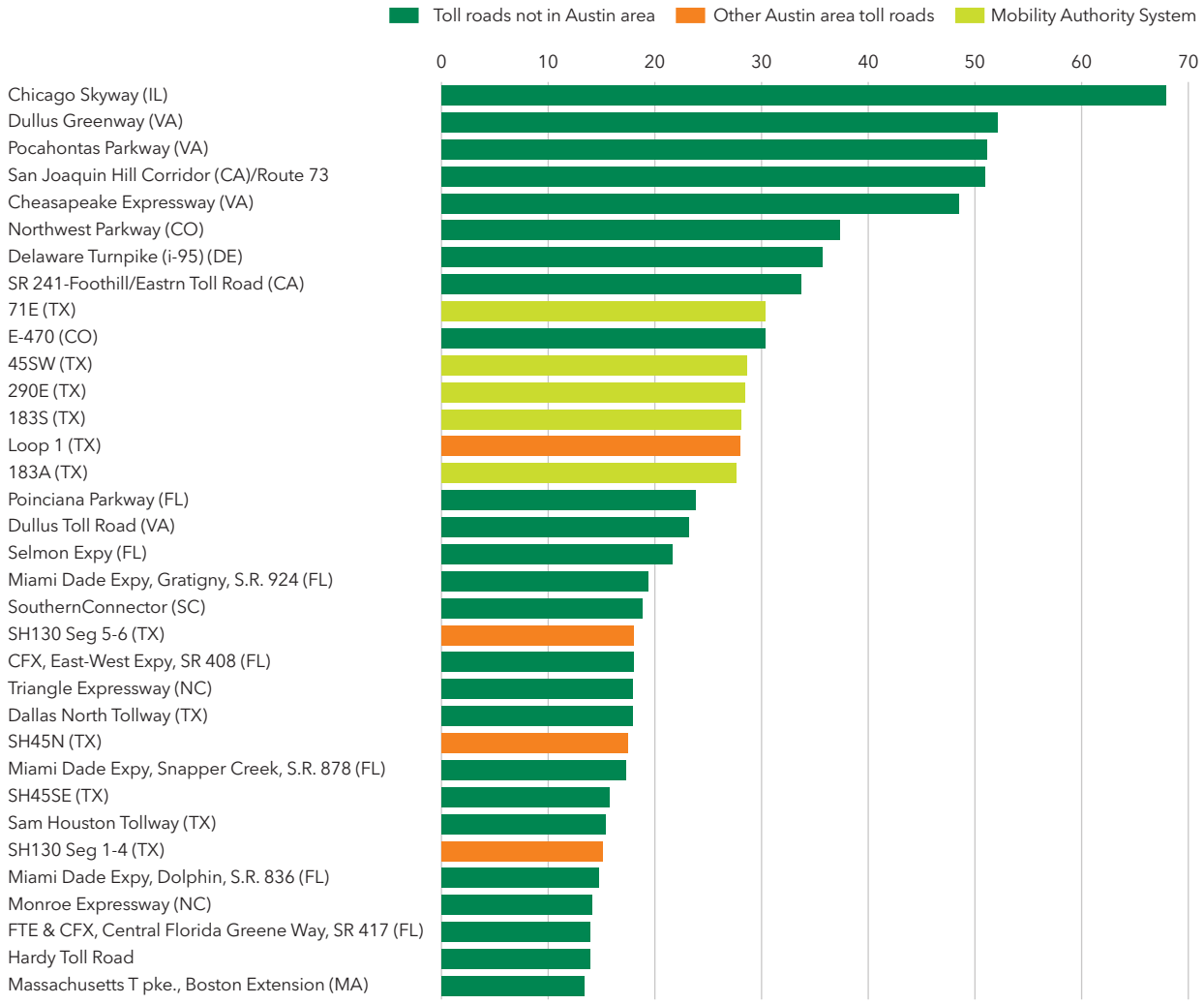
- Policy-makers and the public are more likely to support toll roads that represent a strong value for money proposition;
- Rating agencies, debt providers and insurers regard good value for money as being credit-positive;
- Equity financiers regard good value for money as being investment-positive.

The industry-standard benchmark for value in the toll road sector is cost per mile. How much does travel cost and how does the unit cost of using a specific road, bridge or tunnel stack up against others? This is regularly presented in consultants' reports (see chart 1), accompanied by a reassuring write-up: "This rate per mile is consistent with many… toll facilities"; "The toll rates are typical for this type of… facility"; "The passenger car per-mile toll rates… are still very reasonably priced compared to other toll facilities".

At first glance, the cost per mile metric appears to have some attractive qualities. Top of the list is data availability and ease of calculation. All that is needed is the length of the asset and the respective toll price – information generally in the public domain. However, computational convenience and usefulness are two separate matters. And computational convenience quickly falls away when you get into the details.

On multi-access facilities, different users make different trips of different lengths. So, what distance should be used? And toll tariffs vary by vehicle class, time of day, payment method, trip length, discount eligibility and so forth – so what cost should be used? For this reason, simplifying assumptions are adopted by benchmarkers, the details of which often remain frustratingly opaque. These data standardisation challenges can be overcome. However, a critical issue remains. Cost per mile – essentially price – is being used as a proxy for value. As we demonstrate later, it is a fundamentally flawed metric in this regard.

Chart 1: Typical example of toll road benchmarking (Cents per mile)



Proxy metric shortcomings

From an economics perspective, cost per mile is focused on supply. It attempts to summarise a toll facility in terms of two of its physical attributes: length and price. This is like benchmarking restaurant cuisine simply by comparing the kitchen floorspace. It conveys nothing about demand, or the consumer utility derived from goods and services. That is where the benchmarking metric needs to focus if value is to be assessed and communicated. What do consumers respond to? What are they actually paying for? As most toll facilities operate in a competitive environment, consumers have a choice. They are not responding to facility length. Consumers respond to the amount of time saved compared with alternative route options, which they evaluate in the context of the price point.

Herein lies the danger. The proxy metric, cost per mile, *may* be related to time saved. However, if your benchmarking sample is not populated with near-identical facilities, that relationship quickly breaks down. A cost per mile comparison of toll facilities with different features and offerings ignores the reality of the consumer experience. At best, it is a questionable metric. At worst, it is a misleading value for money indicator. This is why we ignore cost per mile comparisons and focus, instead, on quantifying, understanding and benchmarking cost per minute saved.

Original research

To illustrate the point, we undertook some original research relying solely upon publicly available data. This introduced limitations, but it demonstrates what can be achieved quickly, without having to commission expensive traffic surveys or purchase mobility

data from third-party vendors. Importantly, it is reproducible. Interested parties can replicate what we have done and incorporate it in their own due diligence of target toll facilities. However, our primary objective was to calculate cost per minute saved for a large sample of toll facilities and contrast the results with cost per mile benchmarks.

The hypothesis

Cost per mile comparisons commonly rank toll facilities in order; ascending or descending depending on the preferences of the benchmarker. If price (cost per mile) is a good proxy for value (cost per minute saved), then a comparison of both metrics should result in identical – or near-identical – rankings. This is the hypothesis we set out to test.

The dataset

We started with the Federal Highway Administration's online inventory of US toll roads, bridges and tunnels. This lists 466 facilities spread across 35 US states and territories. To contain the exercise, we focused on a subset; the 190 listed toll bridges and tunnels. Of that 190, we removed 34 facilities that were very different from regular toll bridges and tunnels: international border crossings. We also removed 35 that charged trucks only. Our 'starting sample' was therefore 121.

For the purposes of this article, we are focusing on relative travel times and the time savings experienced by toll facility users compared with the best (practical) toll-free alternative. As such, we identified and discarded monopolies. For example, Key Biscayne in Florida can only be reached by using a toll bridge (the Rickenbacker Causeway). We did the same for near-monopolies where the competing routes were deeply unattractive due to the extent of the required detour. Our cut-off threshold was 50 miles (roughly an hour of extra travel time). From New York City, for example, the first toll-free bridge you can use to cross the Hudson is in Albany, 140 miles to the north. Additionally, we removed toll facilities that only compete with other toll facilities. The result of the above was to reduce our sample from 121 to 83.

A final adjustment to the sample was made when we analysed the competing routes in detail. We had already applied our 50-mile cut-off threshold but noticed that some detours were still costing more in terms of additional fuel than the respective price of the toll. These detours make no sense. The facilities were discarded resulting in a sample of 68 bridges and tunnels carried forward for full analysis. Of the 68, 43 tolled in both directions with 25 tolling in a single direction – giving 111 user-paid routes for comparison against their toll-free competitors. This is substantially more than is shown in traditional cost per mile-based benchmarking.

Our focus on toll bridges and tunnels was purely pragmatic. These tend to be short-distance facilities that offer meaningful time savings. Whereas cost per mile makes little sense for longer toll roads, it makes no sense at all for facilities that are generally just a couple of miles in length. Despite this, we still come across cost per mile comparisons of toll bridges and tunnels in consultants' reports.

As a sidebar, if you compare cost per mile rankings published in different reports you come across some anomalies. Chicago Skyway, for example, is commonly at or near the top of toll road rankings (most expensive) yet near the bottom of toll bridge rankings (least expensive). At under eight miles, some argue that it is a short, elevated highway whereas others maintain that it is a long bridge. Comparisons based on cost per minute saved circumvent such arbitrary classification issues.

Research results

Before we present our research results, it is worth recalling the contextual framework: what we did, how we did it and, importantly, why.

The aim of the research was to test the hypothesis that price (cost per mile) could be used as an effective proxy for value (cost per minute saved). For comparison purposes, we prepared an initial set of cost per minute saved estimates for many toll bridges and tunnels in the US. We did not set out to reproduce the work of full traffic and revenue studies (which cost hundreds of thousands of dollars and take months).

Importantly, we restricted ourselves to publicly available information – reflecting real world constraints often faced by infrastructure investors. How can we form a view about a toll facility with no/limited information? How can we independently sense-check the conclusions of a vendor's traffic and revenue study? Which candidate investments are worth prioritising and pursuing further, while containing our resourcing costs? Investment analysis is and has been our focus throughout.

Having prepared our time saving estimates, we set them against their respective tariffs. Then, like the cost per mile benchmarks, we ranked them – a representative selection of which is presented in chart 5. This table shows 15 bridges/tunnels ranked from high (orange) to low (dark green) using total cost at the control (1st = most expensive). Alongside we show the respective rankings by cost per mile (price) and cost per minute saved (value). The Throgs Neck Bridge in New York, for example, is one of the most expensive facilities in terms of total cost (orange). It ranks in the top half of our sample by cost per mile (relatively high cost

The analysis: A 6-stage process

1 Compile travel time savings

To compile actual (observed) time savings, we used Google Maps' Directions Application Programming Interface. The compilation process involved three steps:

A - Locate the toll bridge or tunnel on a map and identify the immediate catchment areas at either end (the 'core market') where drivers have the choice of using the toll facility or a toll-free alternative.

The core market represents clusters of local origin-destination pairs for which using the toll facility makes most sense. Some toll facilities perform more of a strategic role (focused on longer-distance trips). However, most toll bridges and tunnels were designed to address community severance between local population and employment centres. We start by examining local attractiveness and broaden out, if required, from there.

B - Run the Google Maps' Directions API in 15-minute increments for a typical weekday and extract the travel times, by direction, for the competing routes.

This quantifies the travel time savings – importantly showing how they vary across a 24-hour period – so produces a range of results (see chart 2). The shaded areas represent travel time variability (reliability). The time savings themselves are represented by the difference between the orange and green lines; summarised as yellow bars at the bottom of the chart.

C - From the range of results, compute the typical travel time saving.

When describing data, the median generally provides a good representation of a typical value. From our previous work we observed that the busiest seven or eight hours in a day usually accounts for around 50 percent of a highway's total 24-hour volume, so we used that to identify the median time savings (half of users experience higher savings while the other half experience lower savings).

2 Compile toll tariffs

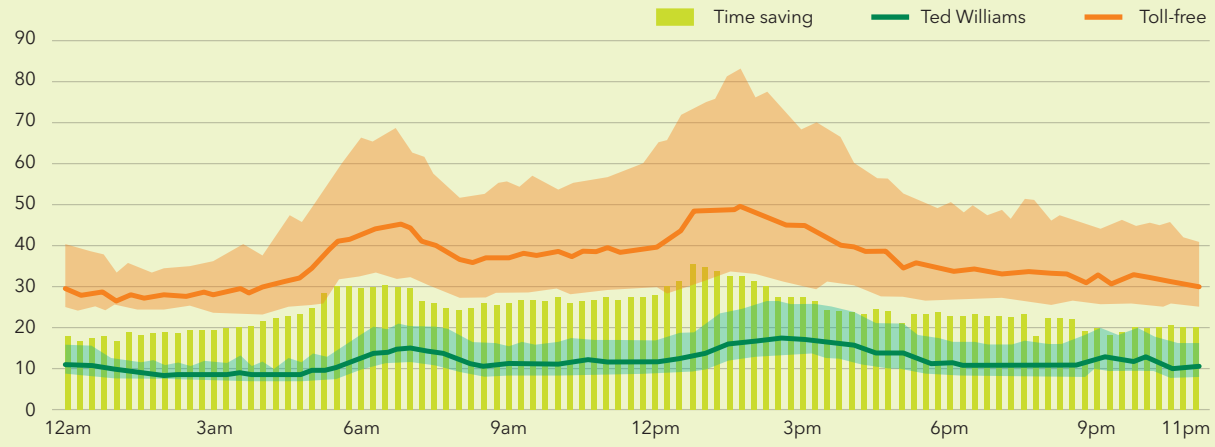
Despite the FHWA's online inventory providing toll tariff data, we ignored it. It lists a minimum fee that includes discounts for high-frequency users and a maximum fee that includes video tolling surcharges. However, most toll road users pay by cash or Electronic Toll Collection. So, we consulted the online tariff schedules for each facility to compile their two-axle (passenger car) rates for 2022. This retains consistency with traditional cost per mile benchmarking which is generally based on cash/ETC rates.

3 Adjusting for local purchasing power

The Bureau for Economic Analysis, part of the US Department of Commerce, highlights the fact that the cost of living – buying power – varies considerably from state to state. In summary, $1 in California buys a lot less than it does in Arkansas. This fact is ignored in all the cost per mile benchmarking we have reviewed, despite comparing facilities from different states.

The BEA publishes regional price parities wherein the differences in price levels across US states and metropolitan areas for any given year are expressed as a percentage of the overall national price level. We used this to adjust our toll tariffs (a proxy for regional value of time differentials). The adjustment range was +/-20 percent.

Chart 2: Ted Williams (MA) – southbound (Travel times from Google Maps, minutes)



4 Estimate the 'reference-value' time savings

Our reference-value time savings are simply those that would be economically justified given the toll tariffs and a specified value of time. We effectively converted the tolls into their time-saved equivalent.

A toll of $5 at a value of time of $20/hour represents the equivalent of a 15-minute time saving [(5/20) * 60].

The value of time used to produce these reference values was that recommended by the US Department of Transportation; $17/hour in 2022 prices.

5 Generate initial value for money estimates

Our value for money calculation simply represents the difference between the typical time savings experienced by users (stage 1) and the reference value time savings (stage 4). To allow comparison across a range of facilities, we express this difference as a ratio.

If the time saving is 15 minutes and the toll justified a 10-minute saving, the ratio would be 1.5.

This ratio can be used in various ways. At its simplest, bigger ratios reflect greater value for money. However, ratios above unity can also be interpreted as a measure of consumer surplus, the extent to which toll bridges and tunnels are undercharging, or the headroom available for increasing the price. Similarly, the variations in time savings across the day (see chart 2) indicate the potential to implement time-of-day (revenue optimising) pricing strategies and the range differentials suggest the extent to which journey time reliability could be a key selling point for a toll facility.

A selection of our estimates is shown in chart 3. Value for money is the difference between the typical time saving (orange vertical market) and the reference time saving (black vertical marker).

Our sample-wide findings are summarised in chart 4. The black line represents our reference-value time savings (using the US DoT-recommended value of time). Using an alternative value of time simply alters the gradient. It has no impact on the position of the markers themselves and no impact on the ranking in terms of cost per minute saved.

The pale green markers are those facilities for which the time savings on offer are broadly in line with expectations (the reference values). The dark green markers to the right represent particularly good value for money. To the left, the orange markers reflect facilities where the value for money proposition is more challenging.

6 Sense check the results

We have been undertaking commercial due diligence of toll roads, bridges and tunnels for over 10 years and, as a result, have amassed a library of nearly 300 traffic and revenue reports. Our library contains full reports for 20 toll bridges and tunnels in the US. As such we were able to compare the high-level value for money results presented here with the findings from technical studies that examined each asset in detail. There was strong alignment. A number of bridges and tunnels represented by our green markers were commented upon favourably by consultants. Their surveys, modelling and conclusions pointed to strong competitive positioning. As for the orange markers, we are currently retained in an advisory capacity by one of the asset owners who is struggling to generate the cashflows anticipated by investors.

Chart 3: Sample of value for money estimates

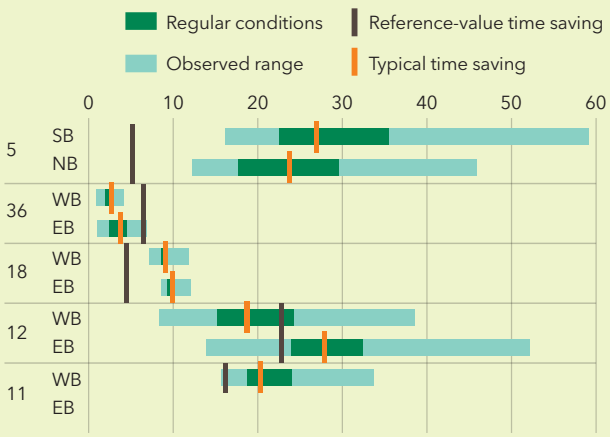


Chart 4: US toll bridges and tunnels – value for money

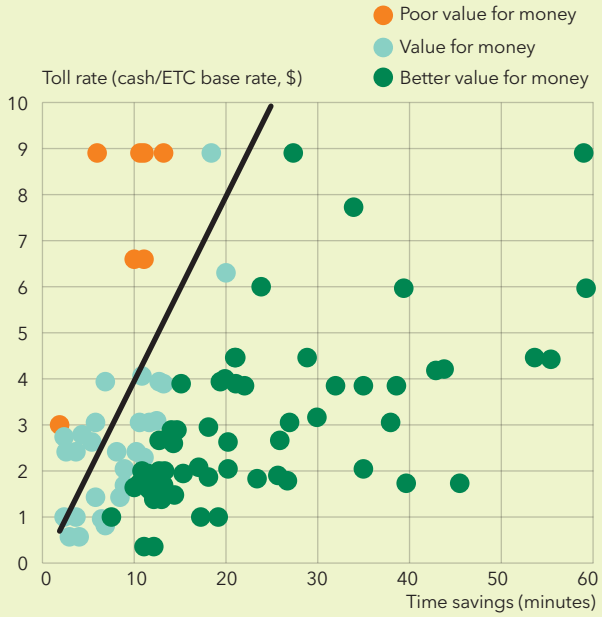


Chart 5: Asset rankings by alternative metrics

Bridge/Tunnel	Toll cost ($)	Rank	Cost/mile ($)	Rank	Cost/min ($)	Rank
Queens Midtown (2 Tubes)	10.17	1	3.91	21	1.23	2
Brooklyn Battery	10.17	1	4.84	18	0.85	5
Throgs Neck	10.17	1	3.91	21	0.15	40
Antioch (John A. Nedjedly)	7.00	8	5.00	17	0.12	48
Albert D. Rosellini	4.30	15	2.99	27	0.33	13
Mid-Bay	4.00	16	1.11	50	0.09	60
Venetian Causeway	3.00	24	1.19	47	0.97	3
I-78 Toll	3.00	24	0.44	62	0.26	20
South Norfolk Jordan Bridge	2.75	35	2.75	30	0.19	26
Elizabeth River MidTown Tunnel	2.50	38	2.78	29	0.10	58
Dingman's Ferry	2.00	44	20.00	1	0.19	27
Midpoint Memorial	2.00	44	1.60	39	0.12	47
Lewisville Lake Bridge	1.98	55	0.97	53	0.08	64
Alabama River Parkway Bridge	1.50	60	0.87	54	0.17	35
Mountain Creek Lake Bridge	0.99	65	0.51	60	0.14	43

Rank
1-5
6-15
16-30
31-45
>45

– shown in pale green) yet drops to the bottom half by cost per minute saved (relatively high value – in green).

To prove our hypothesis, all we had to demonstrate was that the price and value rankings were similar. This is clearly not the case. The alternative metrics result in very different rankings which means that price is not an effective proxy for value. Value-based conclusions cannot be drawn from price alone.

Closing remarks

It could be argued that cents per mile benchmarking is a harmless exercise focused solely on price, and that price comparisons still have a role. Yet it is the toll road industry itself that makes frequent and explicit connections between cost per mile and the value of a project.

As for the role, that remains unclear. Chart 1 shown earlier compares a beltway around Raleigh, North Carolina – population 0.5 million – operated by a public agency (Triangle Expressway) with a privately-operated commuter corridor feeding the nation's capital from its affluent suburbs (Dulles Greenway – which additionally serves the region's large international air hub). In other published benchmarking exercises, we have come across short toll roads (less than five miles) being compared with entire systems (approaching 500 miles); again, masked by the cents per mile metric. Traffic consultants never justify their selection of facilities being benchmarked – a departure from good practice. Without deep industry knowledge, it is difficult for anyone to know exactly what they are looking at other than a ranking of random facilities with the bar of interest appearing around the middle or towards the lower end of the range.

As for being harmless, although the readership of consultants' reports may be limited, cost per mile benchmarks are frequently carried forward to pitchbooks, equity research reports, slide decks for investors, internal presentations to credit committees or investment boards and, in the case of chart 1, bond disclosure documentation (Official Statements) – all with a far broader and more diverse audience.

Our final observation is that, somewhat ironically, time savings – not per-mile costs – lie at the heart of what traffic and revenue consultants do. In forecasting models, trade-offs between journey times and costs of travel dictate route choice (the number of vehicles that will use a toll facility). This is seldom reported in detail and never benchmarked. Instead, it remains hidden in the 'black box' – something that could be rectified by more demanding clients.

In summary, toll price should not be confused with project value. As a benchmark, cost per mile is dead. It's about time. ■

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