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Long-Term Projection of Traffic and Revenues for Equity Analysis

By Ray Tillman, P.E.; John Smolley; Kathy Massarelli, AICP; Art Goldberg, P.E.; Art Pratt, P.E.; and Phil Eshelman

For more than 50 years, toll facilities in the United States have been financed by bonds. In the past year, however, long-term lease transactions involving the Chicago Skyway, the Indiana Toll Road, and, more recently, the Pocahontas Parkway in Virginia have changed the playing field. More states are looking at this type of arrangement, which, unlike earlier deals, can combine debt and equity financing.

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Whereas debt financing is typically paid off in 20 to 30 years, equity financing is "patient" and looks to the deep long term (roughly 50 to 80 years) for return on investment. This approach fundamentally changes investor risks and rates of return. Accordingly, in analyzing the prospects for equity deals in transportation, one must revise the traditional approach to traffic and revenue forecasting to consider the possible range of values and reliability of factors affecting such projections over the long term.

This paper outlines the major variables and general forecasting methodology appropriate for the long-term projection of traffic and toll revenues (T&R) for equity analysis purposes. The authors also demonstrate the use of a graphical format, shown in figures throughout the article, for presenting T&R outputs. Additionally, the writers note parameters (confidence levels and probability) that affect the usefulness of T&R outputs for equity assessments.

The subheadings below correspond to categories of variables that are inputs to the estimating procedure, followed by analysis methodology and output formats.

The forecasting parameters and approach the authors outline are particularly important at two stages in the overall process.

The first stage entails helping public-sector clients understand important aspects of the bidding process prior to the actual bidding. These aspects include:

- Transportation system usage;
- T&R levels over an extended period of time;
- Request-for-proposal (RFP) and concession terms and conditions; and
- The likely range of private-sector bids for a particular facility and set of concession provisions.

The second stage relates to bid development by a prospective concessionaire and bid evaluation by a sponsoring/owning agency. Substantiation of the bid's derivation to both debt and equity analysts is crucial for the credibility and success of the process. A full disclosure of project value and bid bases also helps greatly in the appropriate discussion of public interests and objectives, private-sector objectives and true profit levels, and risk identification and allocation.

Input Variables

Toll rates. Toll rates are driven or constrained by likely concessionaire agreement provisions. References are frequently made to escalation bases, such as the consumer price index (CPI) or an increase/modification needed to maintain a rate-of-return target, or an annual maximum increase and its frequency of implementation. Recently, the concept of "effective spending power" has been mentioned; this is, in effect, a markup of the CPI to reflect possible public perceptions regarding a minimal rate in line with economic trends.

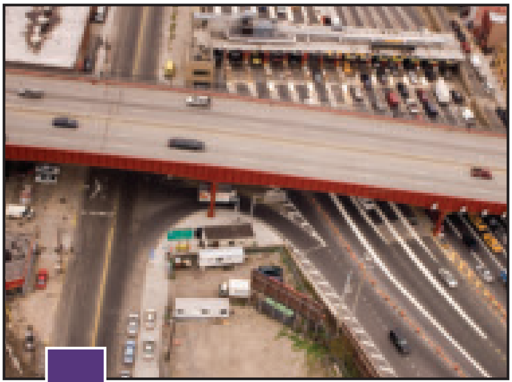
Variable pricing by time period or level of congestion may be another aspect of the toll-rate structure, as may be volume discounts or special rates for particular user categories (such as commuters, HOV lane users, and hybrid vehicles) to attempt to achieve government policy objectives.

Elasticity. The effect on traffic of changes in toll rates has typically been estimated by either revealed preference, stated preference, or the results of sequential regional transportation model runs at alternative toll levels. Often, elasticity has been within the 0.1 to 0.3 range (where a 10-percent increase in a toll rate producing a 1-percent decline in traffic yields an elasticity of 0.1). Ideally, two of these three estimation procedures should be employed to achieve an adequate comfort level with regard to elasticity factors.

Estimates of future traffic volumes are based on an analysis of the regional transportation network and the existing and proposed competitive routings, feeder roads, and other components of the highway network.

Considering long-term projections and the possibility of frequent toll increases, the relevant questions to be addressed are how elasticity factors may change over several decades and to what extent frequent toll increases will directly affect the elasticity values calculated on a "single" increase basis. There is no apparent basis for changing elasticity factors over the long term, but one could assume that a toll increase within one to two years of the previous increase might have a higher elasticity than otherwise calculated.

Regional roadway characteristics. Estimates of future traffic volumes are based on an analysis of the regional transportation network consisting of the subject facility (existing, modified, or proposed) and the existing and proposed competitive routings, feeder roads, and other components of the highway network. The major network characteristics considered are travel times and approximate traffic-carrying capacities. Typically, local and regional government agencies are relied upon to provide information on how network improvements or modifications could occur in the future. However, government programs are often limited to 5 or 10 years, which is inadequate for long-term projections. In such instances, the forecaster should include possible improvements beyond 10 or 20 years that could be considered necessary, and run sensitivity analyses to assess the impact on the subject facility of such changes to competitive or feeder routes.



Currently, regional transportation models include roadway capacities based primarily on the number of lanes and the functional category of the roadway itself. Increasingly, however, the use of various types of managed-use lanes (MULs) and intelligent transportation systems (ITS) techniques could affect the traditional lane-capacity values implicit in current modeling procedures. Looking ahead several decades, various techniques for controlling traffic and closing the gaps between vehicles could also significantly affect lane capacity. Such techniques could include in-vehicle, radar-based following-distance controls and pavement-guidance systems.

Land use. The type and intensity of land uses in the area served by the subject facility, and how they vary over an extended period, are major factors in forecasting long-term traffic demand. Current land uses, and growth or changes typically up to 30 years, are reflected in regional models, but longer-term changes often are not. Although models are responsive to the socioeconomic forecasts of the general area and specific subareas, the potential range (and probability) of various population, employment, and other socioeconomic indicators must be assessed.

Over the course of 50 to 80 years, development cycles, as well, will need to be acknowledged. Growing communities may become mature and growth could stop or even decrease. Also, changing demographics (for example, an aging population) could change trip generation and characteristics.

Land use is also driven, on a “micro” basis, by real estate trends and entrepreneurial decision-making. An industrial park or shopping center near an interchange can have a substantial effect on traffic and revenues, for example. For long-term forecasting purposes, therefore, the opinions and assessments of real estate experts, as well as those of economists, should be obtained.

At this time, interactive modeling of land use and transportation improvements is carried out only infrequently. With the need for longer-term forecasting, however, it will become increasingly important. Major highway construction will have a significant impact on long-term land-use development patterns and should be analyzed using currently available interactive land-use/transportation modeling techniques.

Socioeconomic parameters. As alluded to above, a typical planning organization generally considers 20- to 30-year forecasts of population, employment, households, and median household income in its transportation model. These factors can be influenced by noneconomic considerations, such as political pressures to spread growth around a region rather than focusing it and overly growth-oriented or conservation agendas that don't reflect reality. A longer-term forecast requires both longer-term socioeconomic analyses and consideration of possible political pressures on the planning process. One approach to preparing such long-term assessments is to compare how one urban area relates to national trends or to trends of competing urban regions.

Economic cycles are typically reflected in current analyses by noting that the traffic and revenue trend lines are the "average" of various economic cycles, and individual annual values may thus vary based on their position in the cycle. This approach is reasonable for long-term forecasts, as well, and should be recognized in the evaluation of output data.

Modal splits. The effect of modal shift in most project-oriented modeling is generally limited, because travel habits and preferences are quite ingrained in the public psyche. However, an assumption of no significant modal shifts in a 50- to 80-year forecast may be inappropriate, because greater congestion and travel delays could alter the public consciousness and government transportation funding priorities. The construction in a corridor of a light-rail line or a bus rapid transit (BRT) facility, or some other transportation improvement, could have a significant effect on traffic and toll road revenues, which may be worth investigating.

Another example of a modal split that could affect traffic levels is a shift from air to rail travel that could alter traffic on a route serving an airport or rail terminal, particularly where there is a substantial interurban component to traffic using the facility under examination. Changing a general-use traffic lane within an existing roadway to a high-level BRT lane could also alter traffic volumes and distribution in the network. The modal split in the future could be partially "virtual," as well, as telecommuting becomes a more viable option.

Trip-purpose mix. While not directly included in most modeling/analysis procedures, the trip-purpose mix and how it has varied in the past and might vary in the future is of considerable interest. A highway serving a recreational area, for example, is far more vulnerable to changes in economic cycles and disposable-income levels than is a facility serving commuter traffic. In most cases, the trip-purpose mix is derived from survey information. When two such sources several years apart can be compared, or when long-term land-use projections clearly indicate a shift in the trip-purpose mix, this should be assessed and reflected in the scenario-development and probability estimations outlined below.

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Energy costs/environmental constraints. Although some data exist on the effect of gas prices on motor vehicle usage, public perceptions may change and gas prices may increase more quickly in the future than in the past. Traditional assessments of these impacts must be reviewed and modified accordingly, with higher vehicle usage costs being modeled to consider substantially higher values than those considered likely at this time, so that a thorough sensitivity assessment can be performed.

Environmental constraints constitute a more general category than many of the aforementioned variables and will apply in a far more varied fashion to individual facilities. Nevertheless, possible policy decisions and implementation of laws and regulations in this area should be considered and assessed. These could be related to air quality, land-use planning, alternative fuels' marketability, restrictions on water supply/sewage connections, and other environmental concerns.

Operations and maintenance costs. Operations and maintenance (O&M) costs are sometimes developed for the calculation of net revenues based on general guidelines from historical performance data for other facilities. This may be a reasonable estimation procedure for determining near-term net revenue, but over a 20-year-plus time frame, a more detailed look at possible variations in O&M levels is very important.

Operations refers primarily to toll collection, and new electronic toll collection (ETC) and open-road tolling (ORT) techniques have the potential to be more cost-effective than other methods that are still prevalent.

Maintenance cost estimation frequently assumes increases comparable to the CPI or wage-rate increases, which, again, may be reasonable for short-term forecasting but not for the longer term. It is essential that maintenance costs be broken down by category and that appropriate material or labor factors be applied to each. Furthermore, possible major maintenance items and their likely or possible timing must be separately identified and estimated. Over a 20- to 30-year time frame, it may be reasonable to assume that bridge redecking, for example, may not be necessary; however, when estimating maintenance costs over a longer term, this is a critical major maintenance cost item that must be carefully addressed. The timing of pavement resurfacing, and the need for periodic subgrade replacement, must similarly be estimated and reflected in major maintenance costs or annual contributions to the major maintenance reserve fund. Further complicating cost estimates are advancements in highway construction and maintenance materials and methods that will be made over the course of the "deep future" forecast.

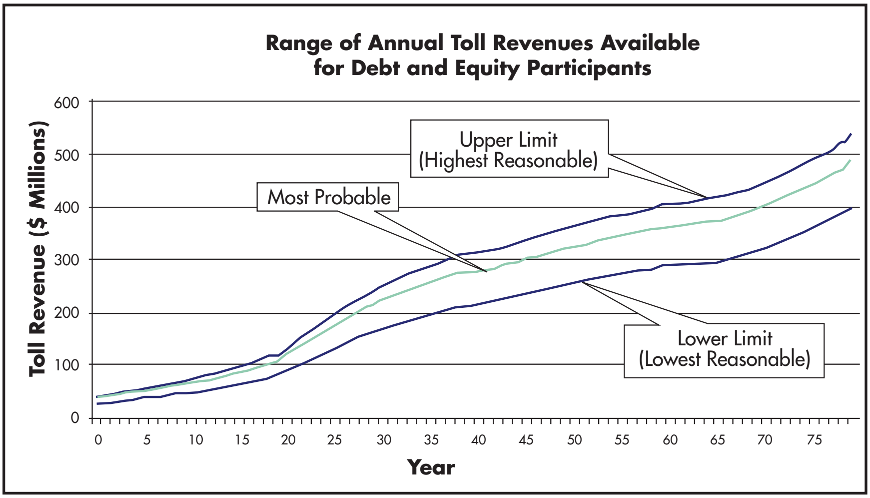
Analysis Methodology

The basic tool for long-term T&R forecasting is still the validated regional transportation planning model focused on a study area of interest. However, the modeling effort must be substantially expanded to include a broad range of data that can be independently analyzed and assessed and then reintroduced into the modeling process.

It is important that the model handle three to four time periods of the day separately (peak, off-peak, midday/nighttime, and weekend day). Travel demand, resulting traffic levels and congestion, and network performance can differ markedly between time periods of the day. Particularly when revenue estimation depends on this variation, it is essential that three or four time periods, rather than a 24-hour or peak-period model, be used.

The modeling effort should also assume that operational or other low-cost remedial measures to relieve congestion and improve network performance will be undertaken by cognizant agencies. Such measures could include intersection treatments, parking regulation changes, ITS implementation, and the like. (Possible major improvements, as noted previously, should be the basis for sensitivity analyses).

Figure 1

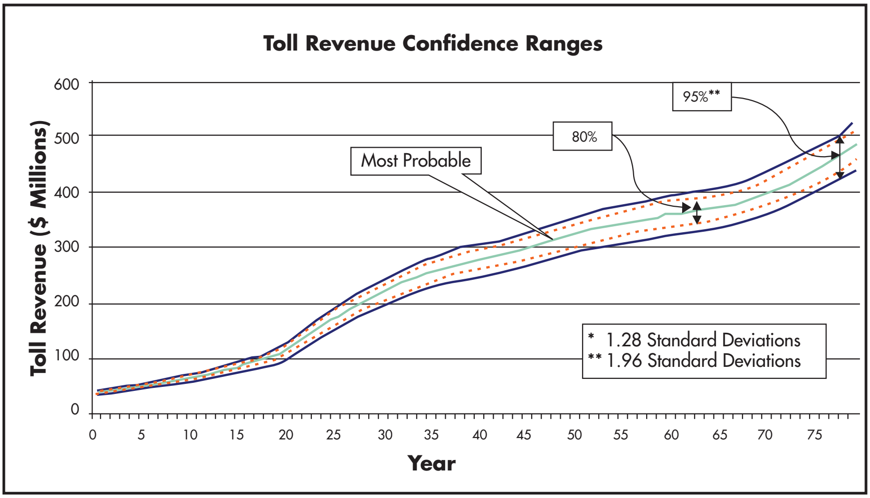


Next, the likeliest values or levels of each of the variables noted above should be used to produce a base "most likely" or "most probable" long-term forecast of net toll revenues, as illustrated in Figure 1. (Besides reducing gross toll revenues by O&M costs to calculate net toll revenues, one could include other, nontoll revenue sources, such as concessions.)

A broad range of sensitivity runs and tests constitutes the next element of the approach. Each of the variables considered possibly significant should be independently tested via successive model runs, and the effect on the "bottom line" (traffic assignments on key links and overall traffic levels and project revenues) should be ascertained. At this point, potential interrelationships between the variables should be identified, and the variables relevant to these interrelationships should be tested again in appropriate combinations to determine any sensitivity effects on overall traffic and toll revenue. Also, variables lacking significant effects on overall traffic and toll revenue should be screened out.

A series of scenarios, ranging from those producing lowest reasonable overall traffic and revenue to those yielding the highest, should then be developed. Each scenario will represent a combination of values for pertinent variables, and the value selected for each variable should be consistent over an "optimistic—pessimistic" continuum.

Figure 2



Output Formats

The simplest way to present the information outlined above would be to plot it on a graph or table showing annual traffic and net revenues that are considered to be, in addition to the most probable over the fore- cast period, the highest and lowest reasonable values for the same years (Figure 1). This would define the range of possible future T&R performance and show revenues available for both debt and equity participants.

The shortcoming of this format is that it does not fully consider the probability of each of the alternative annual levels of toll revenues being realized. In reality, for each year of the forecast period, a distribution curve exists that indicates the likelihood or probability of achieving or exceeding any portion of the most probable forecast. To this end, Figure 2 presents four typical variations in toll revenue for each year on a traditional plot, and Figure 3 shows all variations and probabilities for three key years. These curves could take the shape of a modified Gaussian distribution curve, with one and two standard deviations indicated.

This information should be plotted for key years over the forecast period, so that the shape of the probable distribution of revenue levels based on the various scenarios outlined above can be visualized. For the nearer-term years, when estimation is more precise, these distribution curves would

Figure 3

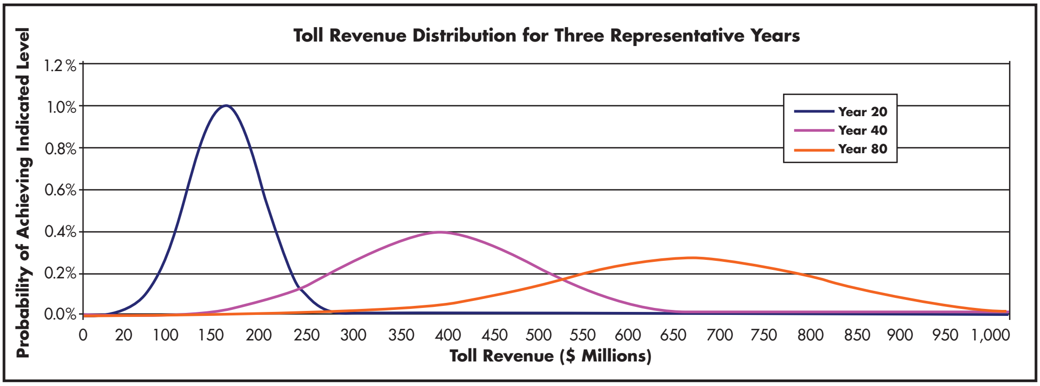
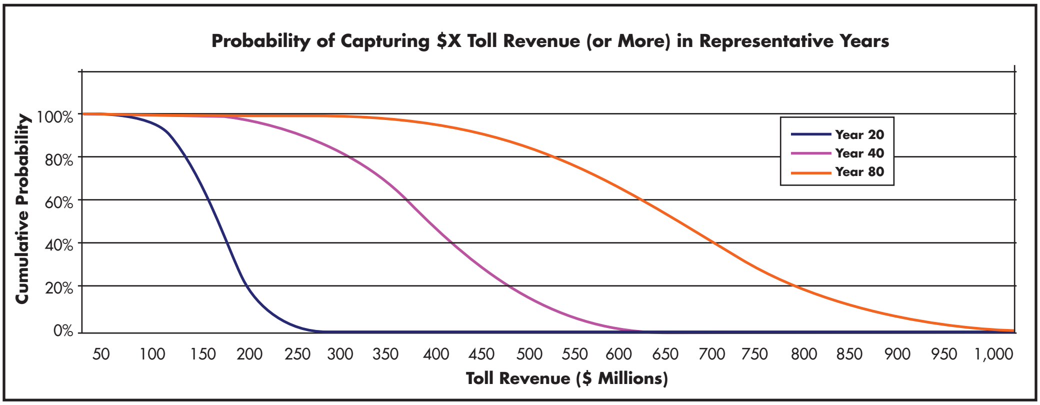


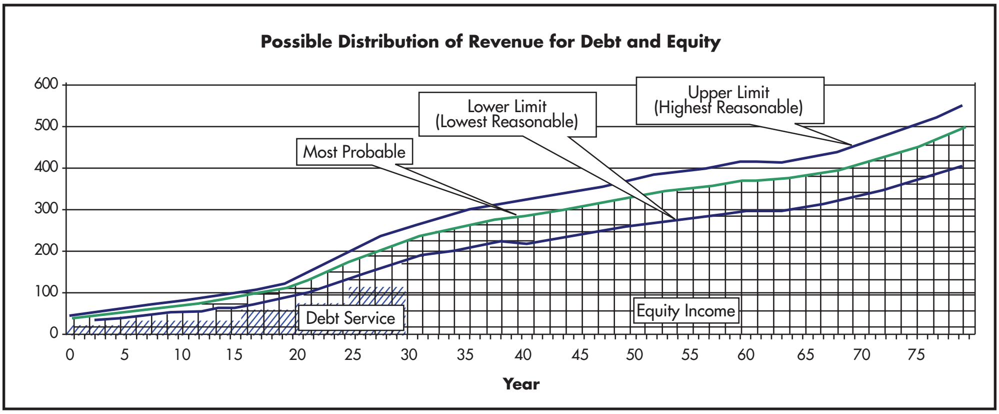
Figure 4



show sharper peaks compared with later years, when assessment of the increased number of variables would yield less precision and the distribution curve would be flatter. Presenting this information as a family of curves or tables would then permit an equity analyst to select a probability and confidence level consistent with his or her analysis needs and to use the revenue numbers corresponding to that probability/confidence level from the graphs or tables presented.

A third type of format could present a family of curves that plots the probability of capturing toll revenues at a certain level or higher for a particular year of interest (Figure 4).

Figure 5



To estimate the range of revenues available for equity participants, the simplified information shown in Figures 1 through 4 could be used to represent the annual net revenue range available for debt and equity participants (Figure 5). Subsequently, the likely debt-to-equity ratio (or various ratios) should be estimated, and the debt service at an appropriate coverage ratio should be subtracted from the revenue levels for each year of the forecast period in which a debt payment occurs. The remainder of the revenues would then equal the range of revenues available for equity participants, including an indication of the probability of achieving these values.

Following the approach and methodology outlined above will permit—and even force—owner representatives, bidders, government agencies, and other public and private interests and stakeholders in the privatization process to address traffic and revenue performance and asset value in a comprehensive, consistent, and credible manner.

The authors of this paper represent the Toll Studies Group of URS Corp., a major international engineering, planning, construction and management firm based in San Francisco. The group's reports have been the basis for well over $40 billion worth of toll-road financings. The authors are Ray Tillman, P.E., senior vice president; John Smolley, senior vice president; Kathy Massarelli, AICP, vice president; Art Goldberg, P.E., vice president; Art Pratt, P.E., senior transportation planner; and Phil Eshelman, transportation planner. Questions and comments may be directed to Ray Tillman at raymond_tillman@urscorp.com.