

FLORIDA'S TURNPIKE

Risk Analysis "Evaluating the Probability of Revenue Traffic" Jack Klodzinski First Coast Expressway NB south of Normandy Plaza

Risk Analysis: Overview

- Revenue traffic has inherent uncertainty.
- Evaluate project alternatives: Part of the PD&E Evaluation.
- Which toll rate is the best?
 Use toll rate optimization.
- What is the probability of revenue attainment?



Risk Analysis: Overview

- Probability modeling on a T&R study can provide a level of confidence for expected revenue transactions.
- Capture the variability of factors such as change in land use, competing roads or value of time.
- Probability Modeling **Response Surface Model Process:** Input Data Input Distributions ravel Demand Model **Regression Model** with Toll Module Representative Monte Carlo simulation runs scenario runs Traffic **Traffic Estimations Probabilistic Estimate** FDO **Florida Department of Transportation**

Risk Analysis: Probability Modeling

- Estimate variations in forecasted revenue traffic levels.
- Based on variations of key model input variables.
- Risk factors (input variables) varied for predefined number of model runs.
- Traffic volume output used with select input variables for the Response Surface Model.

Other Factors
• Weather
Gas Availability & Price
Highway Network Development
Toll Policy



Risk Analysis: Identifying Uncertain Variables

- Develop probability distributions for the uncertain model inputs.
 - Values of time (VOT) use survey data
 - Network changes
 - FDOT work program
 - Local road improvements
 - Population, employment
 - BEBR estimates
 - Employment projections





Risk Analysis: Response Surface Modeling

- Purpose of regression models is to represent response of demand model to key inputs.
- Selection of demand model runs to formulate a regression model equation: Experimental Design.
- Linear regression model to evaluate the project's risk.
- Use Monte Carlo simulation to derive probability distributions for revenue traffic.



Risk Analysis: Experimental Design

- Define demand model run scenarios.
- Provides information about how revenue traffic is affected by key input variables (e.g., VOT, SE data, network).
- Three test levels to estimate the revenue traffic response surface.
- Define input so effects of each variable can be determined from a small number of demand model runs.

Run	VOT/hr	Population	Network
1	\$Low	Med-Low	2030 CF plan
	\$Medium	Medium	2050 CF plan
	\$High	Med-High	Needs plan





Risk Analysis: Regression Model

- Model equation developed to represent the demand model (example below).
- Output for each build scenario compared to base case.

RevenueTransaction = β_0 + [β_1^* Pop] + [β_2^* VOT] + [β_3^* NeedsPlan] + [β_4^* E+CPlan]

- RevenueTransaction is the daily Vehicle Transactions (traffic volume);
- β are constant or coefficients established from the regression model estimation;
- Pop is the model population;
- VOT is the Value of Time for the model run;
- NeedsPlan is a dummy variable and represents the road improvements as the Needs Plan; and
- E+CPlan is a dummy variable and represents the road improvements only in the Existing + Committed Plan or it could be the Cost Feasible Plan depending on the year being considered.



Risk Analysis: Probability Output

- Sample distribution of daily transactions for 2050.
- Example shows 90% chance the 2050 daily transactions will fall between 11,548 and 26,262.



FDOT

Risk Analysis: Probability Output

Cumulative distribution of daily transactions for 2050.





Risk Analysis: Results

• Typically review three probability levels for each forecasted year: Opening versus Design Year

- -P50
- -P75
- -P90

 Ratio to refine revenue traffic.





Risk Analysis: Summary & Applications

- Due to uncertainties in travel demand forecasting, risk analysis can provide additional information for making decisions on project selections.
- Express / Managed Lanes with dynamic pricing:
 - –Include ELToD Model.
 - -ELToD toll scenarios can provide the additional toll variable information for Probability Modeling.



Mobilitics application for variables not in a demand model.