
The Project Evaluation Toolkit (PET)

- Transportation needs exceed available **funding**. Engineers & planners need tools to quickly assess scenario impacts & **prioritize** potential projects.
- We've developed a toolkit to:
 - Anticipate **long-term project impacts** (including traveler welfare, emissions, safety, & travel time reliability).
 - Evaluate & **compare multiple scenarios** (using NPVs, B/C ratios & IRRs).
 - Enable **optimal allocation** of limited resources.



What PET Does...

- Takes an **abstracted network's link counts** & the region's mode & time-of-day (TOD) traffic shares (& other parameters).
- **Estimates a trip-table** between all nodes using constrained maximum entropy methods.
- Applies **elastic-demand** functions on all OD pairs & **incremental logits** across modes & TODs to quickly equilibrate the new & old networks.
- It is a quick-response, computationally efficient tool that approximates full-scale planning model results, while providing a rather **comprehensive** picture of **project impacts**.



Multi-Criteria Decision Evaluation

BENEFITS

COSTS

Econ. Analysis
(B/C & NPV, etc.)

Traveler Welfare

Reliability

Crashes (Market Costs)

Crashes
(Non-Market Costs)

Emissions

Toll Revenues

Maintenance &
Operations Changes

Initial Design, ROW
& Construction

Interim Project
Costs

- Analysts can **move measures** in & out of economic analysis.
- **Financing Component** assesses to what extent Toll Revenues cover project costs.

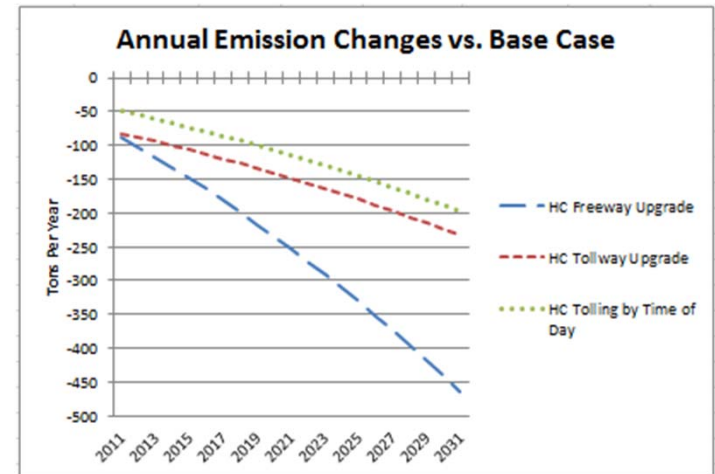


User Interface Provides...

Link-Level Outputs

Link Name	AADT			
	Base Case	Freeway Upgrade	Tollway Upgrade	Tolling by Time of Day
Loop 1: 183 - RM 2222	73131	73021	73067	72888
Loop 1: RM 2222 - 183	72422	71879	72162	71850
Loop 1: RM 2222 - 15th St	77969	78046	77971	78014
Loop 1: 15th St - RM 2222	77671	77671	77671	77671

Toolkit-Generated Charts



Toolkit Navigation

Project Impact Summaries

Output Summary

Summary Charts

Sensitivity Testing

Yearly Costs

Traveler Welfare Summary

Reliability Summary

Crash Summary

User-Input Error Checking

Intersection Configuration - Alt Scenario 3

OK	Area Type Entered for All Intersections
OK	Control Entered for All Intersections
OK	Major Link # or Vol Entered for Intersects
OK	Minor Link # or Vol Entered for Intersects

Engineer's Estimate - Alt Scenario 3

\$80	Initial Costs (\$M)
\$1,130	Add Annual Maint. (\$k)
\$0	Salvage Value (\$M)
N/A	Maint & Rehab Project Year
\$0	Maint & Rehab Project Cost (\$M)

Project Summary Measures

	No Build	Freeway Upgrade	Tollway Upgrade	Tolling by Time of Day
Design Life Year Monetary Benefits	\$0	\$129,817,880	\$90,974,870	\$63,282,700
Traveler Welfare	\$0	\$76,582,840	\$43,791,240	\$23,532,426
Reliability	\$0	\$51,847,861	\$45,893,317	\$38,559,512
Crashes	\$0	\$1,387,179	\$1,290,313	\$1,190,761
Net Present Value	\$0	\$771,916,628	\$282,041,061	-\$42,856,494
Internal Rate of Return	N/A	90.27%	19.26%	3.17%
Benefit / Cost Ratio	N/A	14.41	4.75	0.43
Payback Period	N/A	2.3	9.7	22.8

Sensitivity Analysis

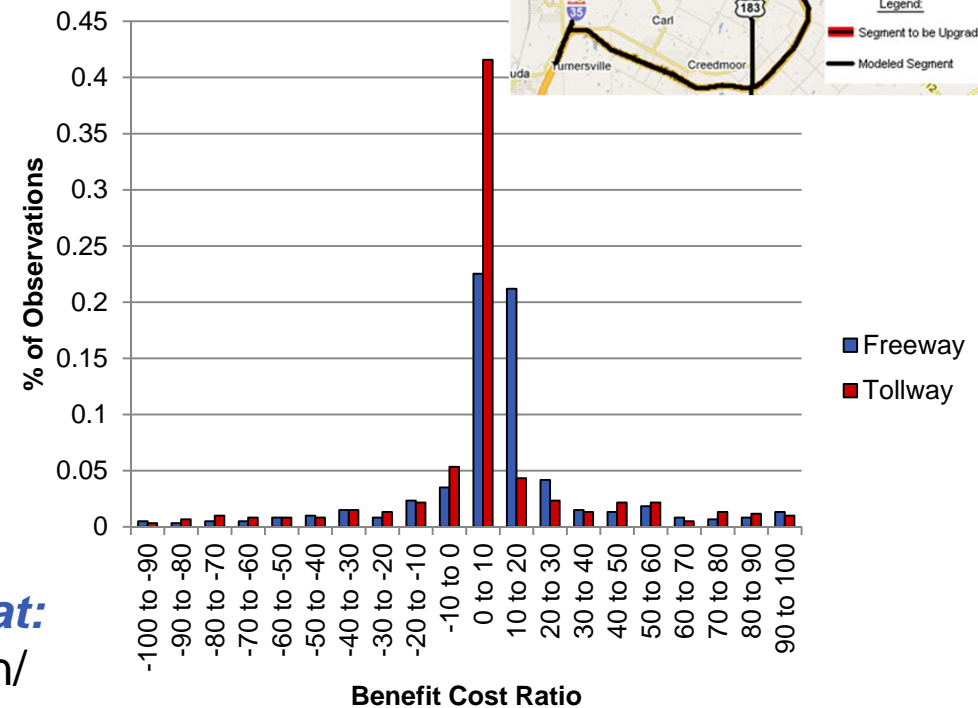
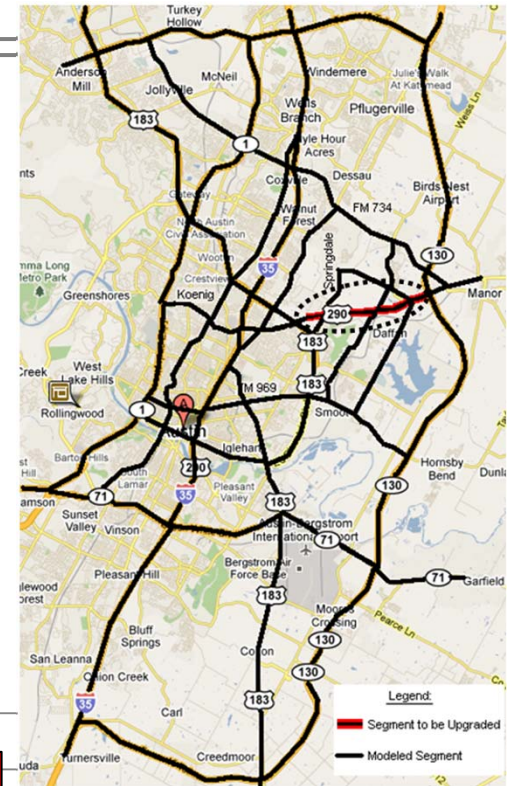
- **28 parameter sets** variable in combination.
- Monte Carlo draws using **lognormal distributions**.
- Random draws specify **% increase** or **decrease** from default value for each parameter.

Variable Parameter Sets		
Values of Time	Free-Flow Speeds	Avg. Vehicle Occupancies
Vehicle Operating Costs	Reliability Parameters	Base User Class %'s
Values of Reliability	Crash Rates	Base Mode Split %'s
Values of Crashes	Emissions Rates	Trip Growth Rates
Values of Emissions	Mode Scale Parameters	Demand Elasticities
Link Capacities	TOD Scale Parameters	Initial Project Costs
Link-Perform. Parameters	Temperatures	Add. Maint. & Op. Costs



Case Study Application

- Austin Tollway & Freeway Upgrades
- Evaluation of:
 - Summary Measures (NPV, B/C ratios, etc.)
 - Crash Changes
 - Emissions Changes
 - Tollway Financing
- Sensitivity Testing also investigated.



Download & find out more about PET at:
<http://www.ce.utexas.edu/prof/kockelman/>

Results: Summary Measures

- Preferred Alternative: **Freeway Upgrade**
- However both the **Tollway Upgrade** or the **Tolling by Vehicle class** alternative scenarios deliver substantial traveler benefits while providing funds to finance the project.

	Base Case: No Build	Freeway Upgrade	Tollway Upgrade	Tolling by Veh. Class
Total Initial Costs	\$0	\$71.8 M	\$80.5 M	\$80.5 M
Change in Maint. & Operations Costs	\$0	\$0.43 M	\$1.18 M	\$1.18 M
Interim Project Cost	\$30 M	\$0	\$0	\$0
Interim Project Year	2020	N/A	N/A	N/A

Net Present Value	\$0	\$734 M	\$223 M	\$378 M
Internal Rate of Return	N/A	90%	17%	30%
Benefit / Cost Ratio	N/A	14:1	4:1	6:1
Payback Period	N/A	2.3 years	10.9 years	6.1 years

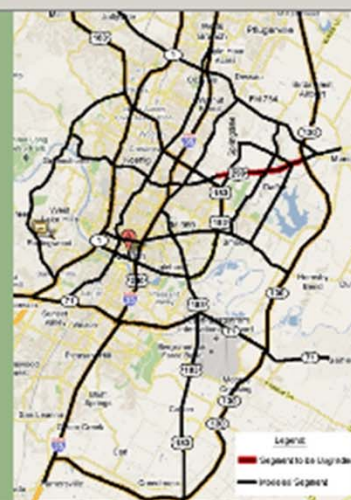
Economic Summary Measures of Project Alternatives





PET

A toolkit for anticipating & comprehensively evaluating transportation project impacts.



[PET Home](#) THE PROJECT EVALUATION TOOLKIT

[Documentation](#)

PET is a **freely available, open-source** transportation project evaluation toolkit that assesses impacts across a variety of project types. Developed by [Dr. Kara Kockelman](#), [graduate student](#) Dan Fagnant and post-doc Dr. Chi Xie the University of Texas at Austin, PET uses existing traffic link counts, behavioral functions, & travel growth projections to estimate changes in travel patterns as a result of construction projects and transportation policy changes. PET quickly estimates how network changes affect benefits & costs to travelers, project financing feasibility, air quality, and crash totals. Summary measures (such as net present values and benefit-cost ratios) are developed over multi-year/long-term horizons to quantify the relative merit of project scenarios, versus a base-case (e.g., no-build) scenario.

[Toolkit Files](#)

[Papers & Slideshow](#)

[FAQs](#)

PET offers valuable predictions of future flow patterns and transportation benefits, enabling transportation planners and decision makers to quickly, quantitatively and objectively compare complicated project alternatives. This ability is particularly crucial as budgets become increasingly constrained, making optimal investment and policy decisions paramount.

[Contact Us](#) PET-Assessed Project Impacts Include

Project #2: “**Encyclopedia**” on Transport Economics for Practitioners

- A comprehensive reference to aid TxDOT personnel (& others) in understanding practical **applications** of transportation economics & underlying **theories**.
- Reference **components**:
 - Main text
 - **Case study** applications
 - **Presentations** (webinar series)
 - Website



Chapter Topics

- **Costs & Benefits of Transportation:** Opportunity costs, direct vs. indirect costs, capital vs. operating costs, marginal vs. average costs, variable vs. fixed costs, external vs. internal costs, joint vs. common costs.
- **Pricing:** Short-run vs. long-run marginal pricing, static vs. dynamic pricing, pricing implementation (congestion pricing, VMT fees), equity issues.
- **Transport Regulation & Competition:** environmental & safety regulations, value engineering, workers' wages, deregulation
- **Movement, Transport, & Location:** access vs. mobility, location choice, land values, wages, economic development.
- **Investment & Financing:** economic roles of road & rail infrastructure, revenue sources, expenditure sources, innovative financing methods.



Chapter Topics (2)

- **Project Evaluation:** Cost-benefit analyses, internal rates of return, payback periods, net present valuation, breakeven analysis, life cycle analysis, constrained optimization, multicriteria analysis, sensitivity analysis.
- **Economic Impact Analysis:** Economic indicators, generative & redistributive economic impacts, paths of economic analysis, input-output modeling, multiplier analysis, computable general equilibrium models.
- **Econometric Analysis:** data sets for regression models, model specification, parameter estimation, nonlinear parameter estimation methods, statistical significance & prediction.
- **Also:** Introduction, **Case Studies** (bypass impacts, ROW costs, port value, congestion pricing, BCA of network improvements), Listing of Data Sets, **Lecture Slides**



Thank you for your time!



Questions & Suggestions?

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