INNOVATION / TECHNOLOGY DEPLOYMENT SUMMARY

Multi-Resolution Modeling to Monetize Construction Impacts

CHALLENGE

Road user costs (RUC) are calculated by combining vehicle operating costs and vehicle delay costs. These components are aggregated based on traffic volume, vehicle types, and travel conditions, often modeled over specific time periods and for specific scenarios, such as roadway or traffic operating conditions. Factoring RUC values into project planning is an effective way to improve decision-making, quantify construction impacts, and ensure timely project delivery. The Waco District, during its efforts to develop incentive/disincentive contractual clauses for the Project 4C Waco South construction project, identified a need for more realistic RUC estimates.

SOLUTION

To develop a methodology to accurately estimate RUC by calculating vehicle delay cost and vehicle operating cost, the project team used a regional, simulation-based dynamic traffic assignment (DTA) model to simulate driver behavior and estimate the impacts of traffic changes at various phases and stages of planned construction. The DTA model accurately captures the dynamic nature of traffic, such as time-varying delay, fluctuating congestion, and route choice due to congestion (Figure 1).

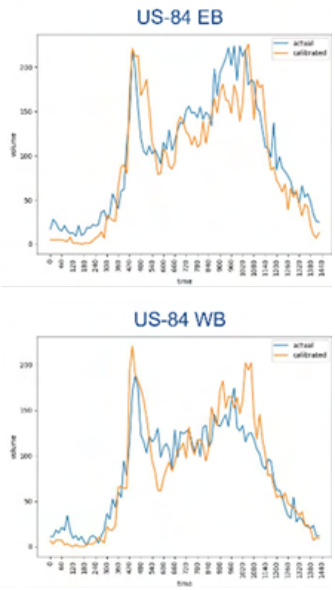

Figure 1. DTA model results validation.

PROACTIVE APPROACH

Using a DTA model for RUC analysis takes into consideration the most realistic decision a driver is likely to make to potentially choose another route to avoid construction or travel through a work zone. The delays the driver experiences are based on cumulative time lost and reduced speeds, affecting vehicle delay costs and vehicle operating costs.

BENEFITS

The DTA model captures dynamic driver behavior better than other methods that fail to take into account driver decision-making over time or in response to changing network conditions. At each stage

TxDOT GOALS

- Deliver the right projects
- Focus on the customer
- Foster stewardship
- Optimize system performance
- Preserve our assets
- Promote safety
- Value our employees

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of construction, the model simulates a typical driver's "best route" choices. Any new delays, reduced speeds, or congestion the driver experiences are additional inputs that improve the accuracy of RUC analyses and cost estimates for each stage of the construction project.

KEY TASKS

- Develop a regional, simulation based DTA model.
- Simulate Waco 4C construction phases and stages from the construction project's existing traffic control plan (Figure 2).
- Post-process DTA model results for northbound and southbound directions of each construction stage.
- Produce RUC analysis reports based on model outputs and estimated user costs (Figures 3 and 4).

DATA SOURCES

Data sources include the Waco District macroscopic travel demand model and the TxDOT traffic count database system.

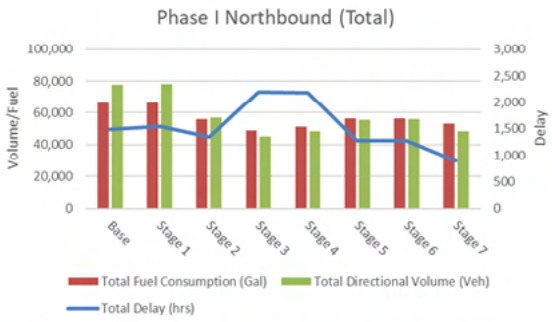

Figure 2. Northbound simulation results of each construction stage.

Vehicle Delay Costs		
Project Name	Waco I-35	
Direction	Northbound	
Phase	Phase I	
Stage	Stage 2	
Duration of work zone (days)	1	
Total Directional Volume	57037	
Total Delay (Hrs)	1342.34	
	Cars	Trucks
Vehicle Composition (%)	76.24	23.76
Value of Time ($/Hr)	$32.83	$45.05
Delay per vehicle class (hrs)	1068.79	273.55
Directional Volume/User Class	43487	13550
Average Delay/vehicle (hrs)	0.02458	0.020
Cost per Vehicle	$0.8069	$0.9095
Total cost	$35,088.38	$12,323.43
Total delay cost per day (cars and trucks)	$47,411.80	

(Delay)*(VOT) = Cost/Veh
(Cost/Veh)*(Directional Vol)=Total Cost

Figure 3. Vehicle delay cost calculation of a construction stage.

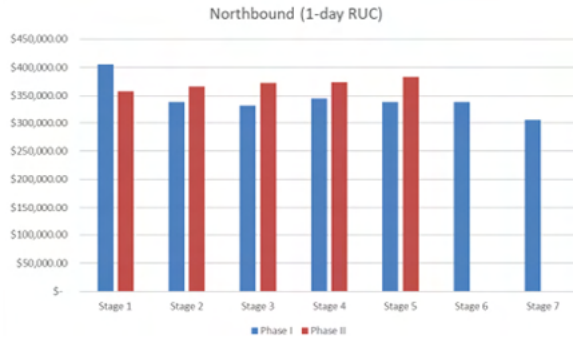

Figure 4. Road user cost results of each construction stage for the northbound direction.

Resources

Waco District (txdot.gov)

Road user costs (txdot.gov)

FHWA Road User Cost Calculator

A case study in El Paso, Texas, using simulation-based modeling methods (sciview.net)

Contact

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