

Executive Summary

Arlington, Texas, is facing rapid growth that intensifies the combined challenges of housing affordability, traffic congestion, and construction impacts. This study develops an integrated, data-driven workflow for the **Matlock Road corridor**, focusing on three key signalized intersections: Green Oaks Boulevard, East Stephens Drive, and Bardin Road. Using **PTV Vissim microsimulation**, we quantified baseline peak-period operations and tested sensitivity to demand increases of up to 30%. Our findings identify **Bardin Road as the critical corridor bottleneck**, supporting a roadmap for prioritized operational and geometric improvements to maintain regional mobility

Background

The Problem: Continued urban growth increases corridor travel demand, while concurrent construction—such as utility work and resurfacing—reduces available capacity and raises user costs.

Societal Context: Technical improvements in traffic management directly impact broader societal goals, including housing accessibility, economic productivity, and regional mobility.

Objective: To identify data-driven solutions that reduce user costs while maintaining feasible staging for future construction and housing growth.

Arlington faces a dual bottle-neck of housing-driven demand and physical constraints from construction. The goal is to find operational breaking points before they occur.. Turning-movement counts were collected during **late-afternoon peaks** at three nodes: Green Oaks Blvd, East Stephens Dr, and Bardin Road. These provide the baseline for the microsimulation.

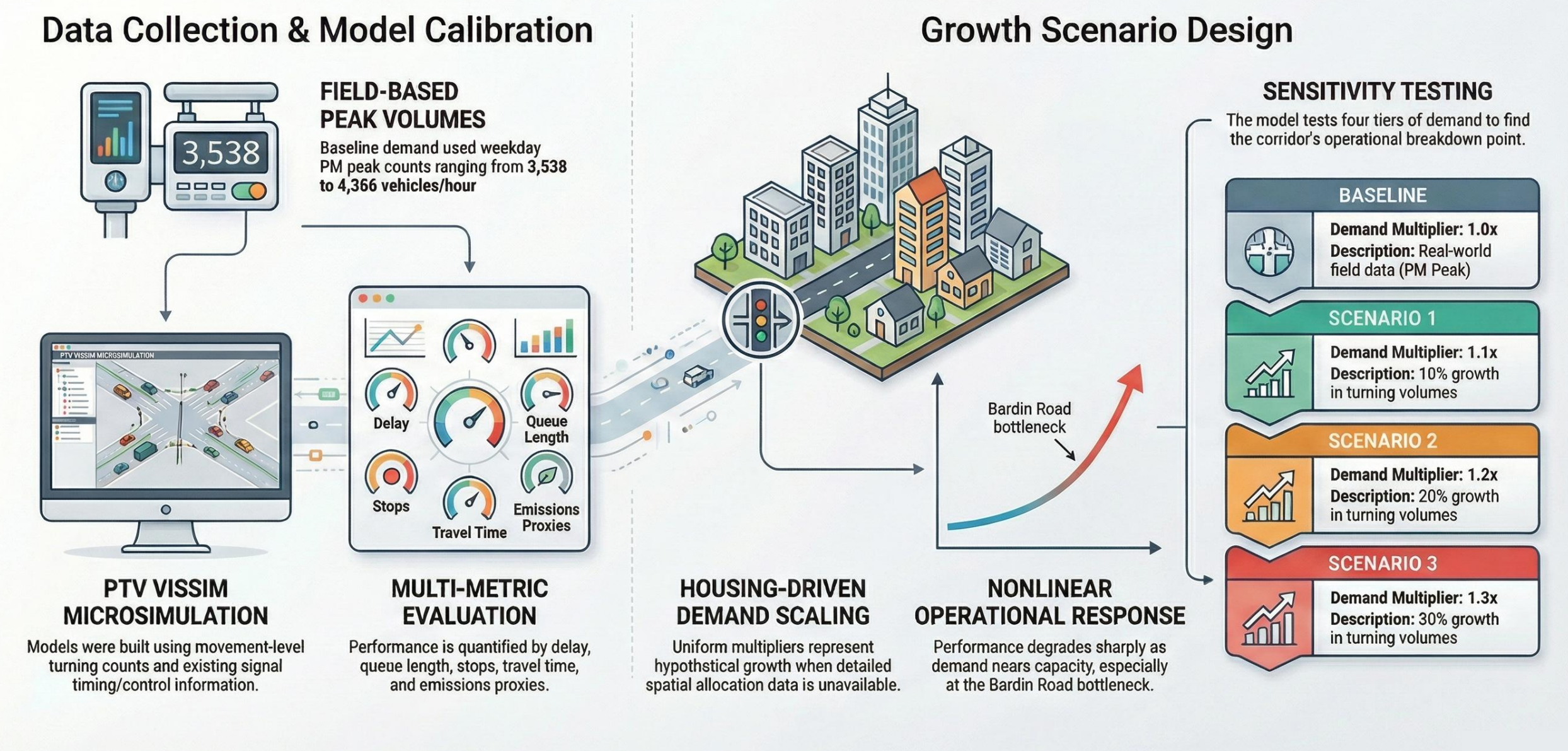
To test sensitivity, demand is scaled uniformly from **Baseline (current data)** up to **Scenario 3 (130% growth)**. This identifies exactly where the corridor's operation breaks down.

	Scenario 1: 1.1x Real Data	Scenario 2: 1.2x Real Data	Scenario 3: 1.3x Real Data
Baseline: Real Field Data		Approaching capacity	Peak stress
LOS mapped to Cool Grey			

Experimental Setup

- Field Data:** Turning-movement counts (TMC) across three intersections; late-afternoon peak periods (December 2025).
- Microsimulation:** **PTV Vissim** corridor model; calibrated using GEH statistics and validated via field-observed signal timings.
- Growth Scenarios:** Four-tier demand analysis:
- Baseline:** 100% real-world demand.
- Growth:** Uniform scaling at **+10%, +20%, and +30%** to simulate housing-driven traffic.
- Performance Metrics:** Quantitative analysis of **Average Delay (sec/veh)**, **Queue Length (ft)**, **Fuel Consumption (gal)**, and **LOS (A-F)**.

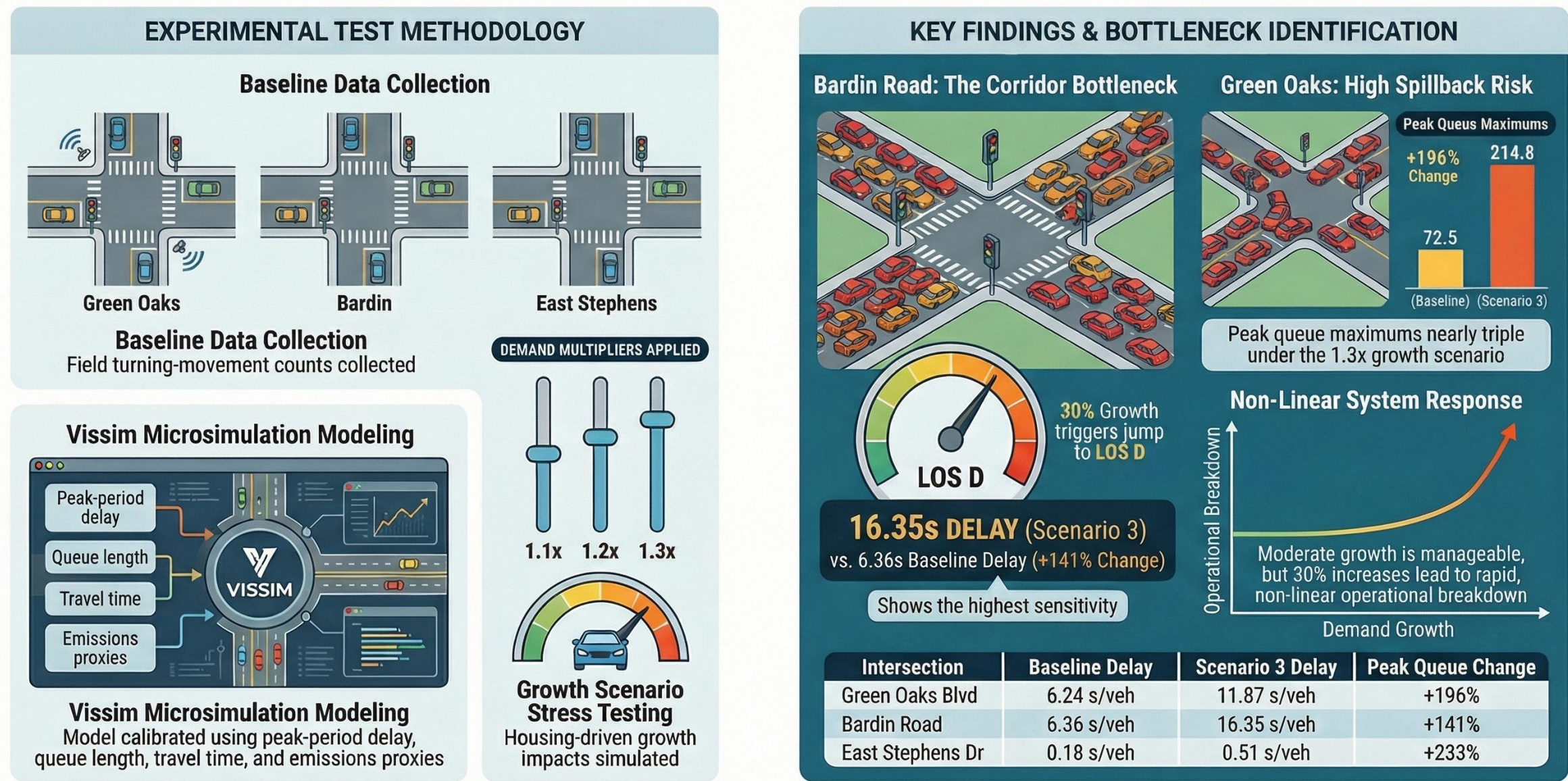
Matlock Road Traffic Study: Experimental Workflow & Sensitivity Setup



Experimental Test Plan

- Integrated Workflow:** Connects housing growth demand with construction staging using **4D scheduling**.
- Stress Testing:** Identifies the precise threshold for **operational breakdown** within the corridor.
- Nonlinear Analysis:** Pinpoints "tipping points" for exponential queuing, specifically at the **Bardin Road bottleneck**

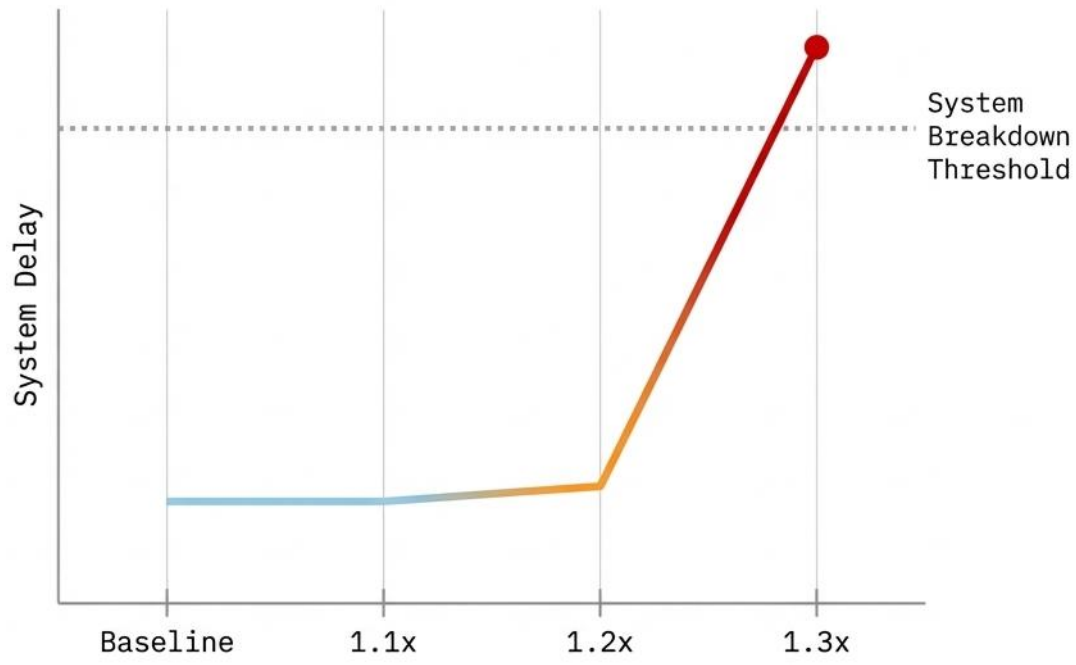
Matlock Road Corridor: Traffic Demand Sensitivity & Experimental Test Plan



Experimental Results

The Nonlinear Breakdown: 30% growth triggers catastrophic system failure

The network exhibits a **nonlinear response** to pressure. Moderate growth produces only incremental changes in average delay, but near-capacity operation under **Scenario 3 (1.3x)** leads to rapidly compounding queues and delay corridor-wide.



Diagnostic 01: Green Oaks Boulevard exhibits severe spillback risk.



Green Oaks Boulevard Spillback Risk: While the Average Level of Service remains functional (LOS B), the **peak queue length surges by 296%**, creating an immediate threat of traffic backing up into adjacent links.

Diagnostic 02: East Stephens Drive remains a resilient node under pressure.



East Stephens Drive (Resilient Node):

This intersection remains the most stable, maintaining **LOS A** even under peak stress, though it still suffers a 12.8% delay increase due to general corridor congestion.

Diagnostic 03: Bardin Road fails catastrophically under 1.3x demand.



Bardin Road (Primary Failure):

Bardin Road is the corridor's weakest link; under 1.3x demand, it plummets to LOS D, proving it cannot sustain a 30% surge without structural intervention.

Table 1. Comparative failure Matrix at 1.3x

Intersection	Green Oaks	East Stephens	Bardin Road
Delay Multiplier	1.9x	2.8x	2.5x
Delay Multiplier	3.0x	3.3x	2.4x
Spillback Multiplier	High	low	Critical
Bottleneck Multiplier	Secondary	Immune	Point of failure

Conclusions

This study provides the data-driven evidence needed to prioritize Arlington's infrastructure investments. By identifying Bardin Road as the critical link, the city can proactively mitigate the "growing pains" of urban expansion, ensuring a smoother journey for every resident.

References

- City of Arlington. (n.d.). *City of Arlington Open Data Portal*. <https://opendata.arlingtontx.gov/>
- Kimley-Horn. (n.d.). *Facility Inventory (Sidewalk) Map*. <https://maps.kimley-horn.com/portal/apps/experiencebuilder/experience/?id=ec792aa997c74954a4dc1b8e25ac8e76>