



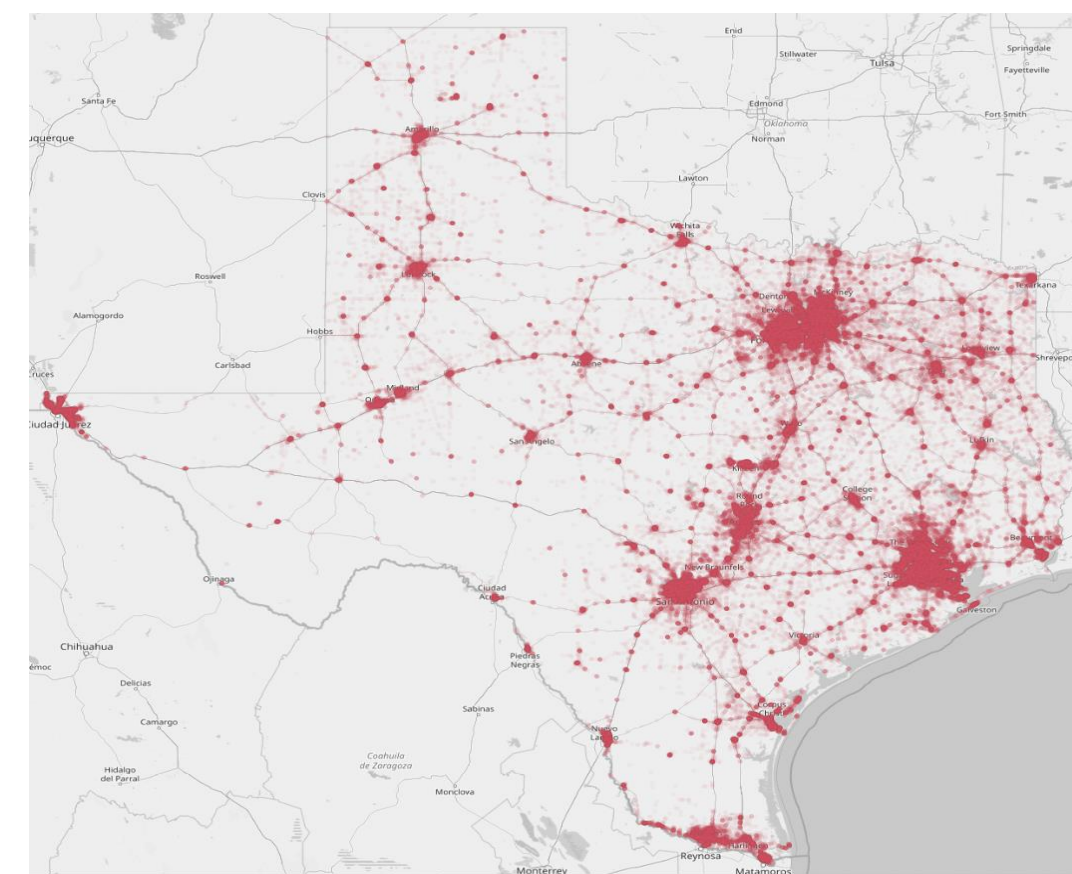
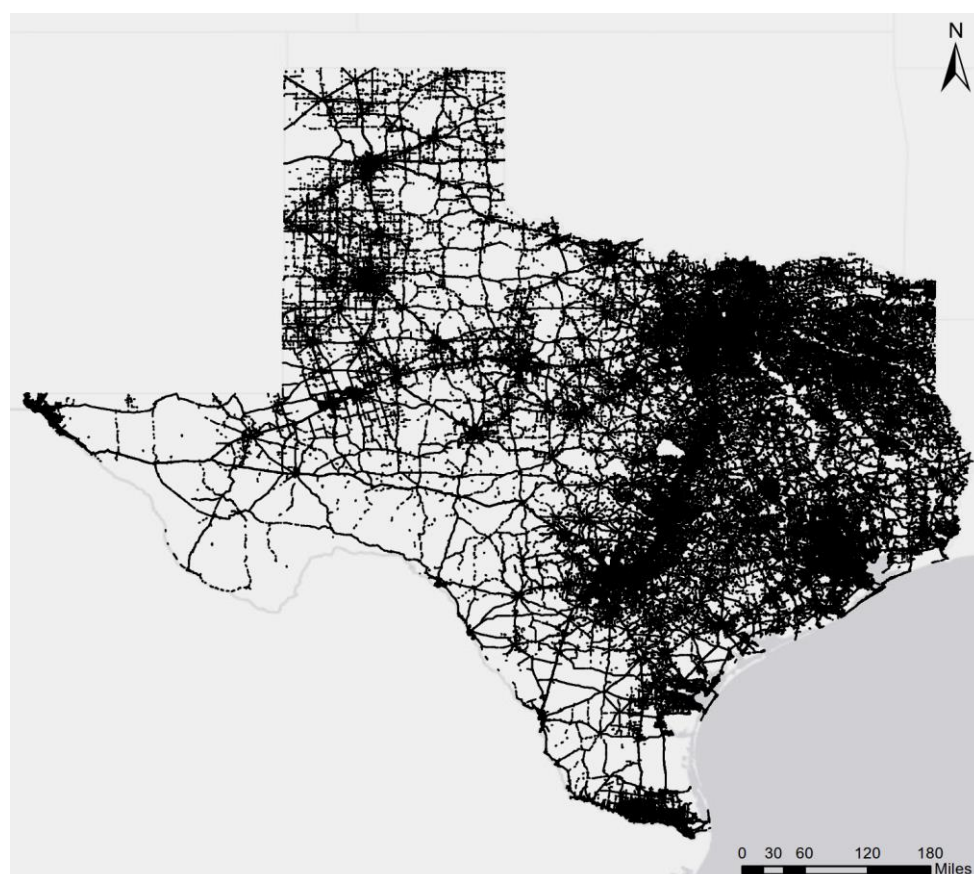
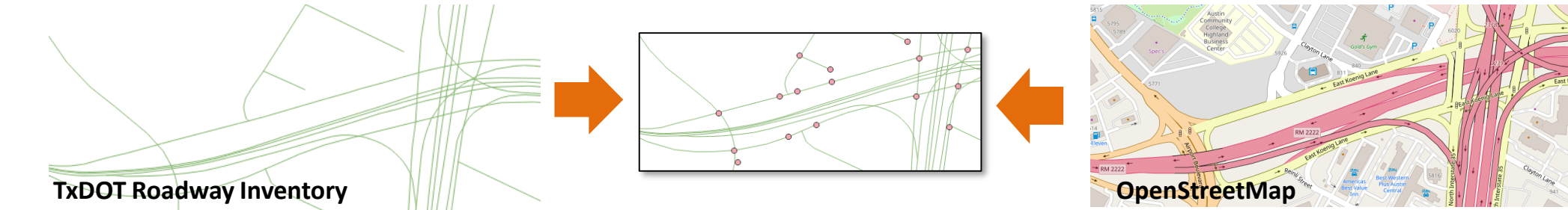
Intro

- **Pedestrian crash rates** (as recorded by US police, per vehicle miles traveled [VMT]) are **stable**, but **ped deaths are rising: +53% in US & +86% in Texas** (2010-2019).
- **Texas' intersection** crashes (with pedestrians) **doubled** between **2010 & 2019** while **midblock** counts **rose 30%**. **City of Austin** is working to achieve **Vision Zero** goals.
- **City of Austin, TX** has **5%** of Texas' ped. crash reports + better variables.
- **This work** analyzes Texas' **5.6M crashes** in CRIS crash **2010-2019** dataset, and identifies **factors** with **greatest impacts** on ped-crash counts & severities, + **most injurious** sites, across **>1 million sites**. (Past studies use **aggregates or small data sets for intersection** details.)



Pedestrian Crash & Site Data

- **Variables** = Crash type, injury severity, location, time of day & week, road geometry, sidewalk & bus stop provision, vehicle & person attributes,...
- **Challenge #1: No intersections** defined in TxDOT's Roadway Inventory.
- **Challenge #2: Extreme segment lengths**, ranging from 5 feet to 44 miles!
- OpenStreetMap, Python, & PostgreSQL to derive **0.1-mile-long** segments, plus ~750K intersections.
- **Intersection signal presence** is derived from OpenStreetMap.
- Statewide **Walk-miles traveled (WMT)** per acre modeled off of National Household Travel Survey add-on + block-level Census data.
- **City of Austin** economic & land use variables obtained from local MPO.



Methods

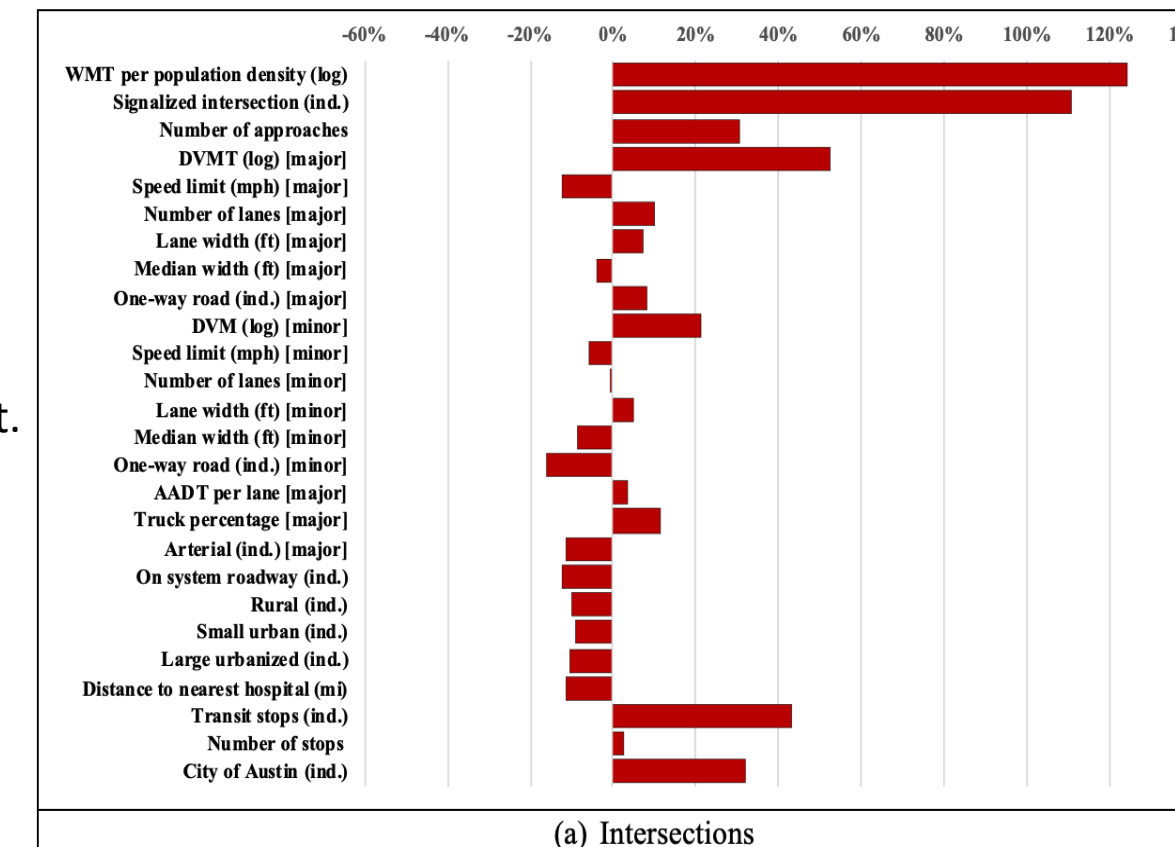
- **Negative binomial (NB) count models** used for ped crash count prediction across Texas & Austin sites (with more covariates added). (NB preferred over Poisson model due to over-dispersion of data: $\rho > 1$)
- **Practical significance** evaluated by individually changing each X covariate (in each data record) up by 1 standard deviation (+1 SD) for continuous variables, or from 0 to 1 for indicator variables.

Results

TEXAS STATEWIDE

Intersection Ped Crashes

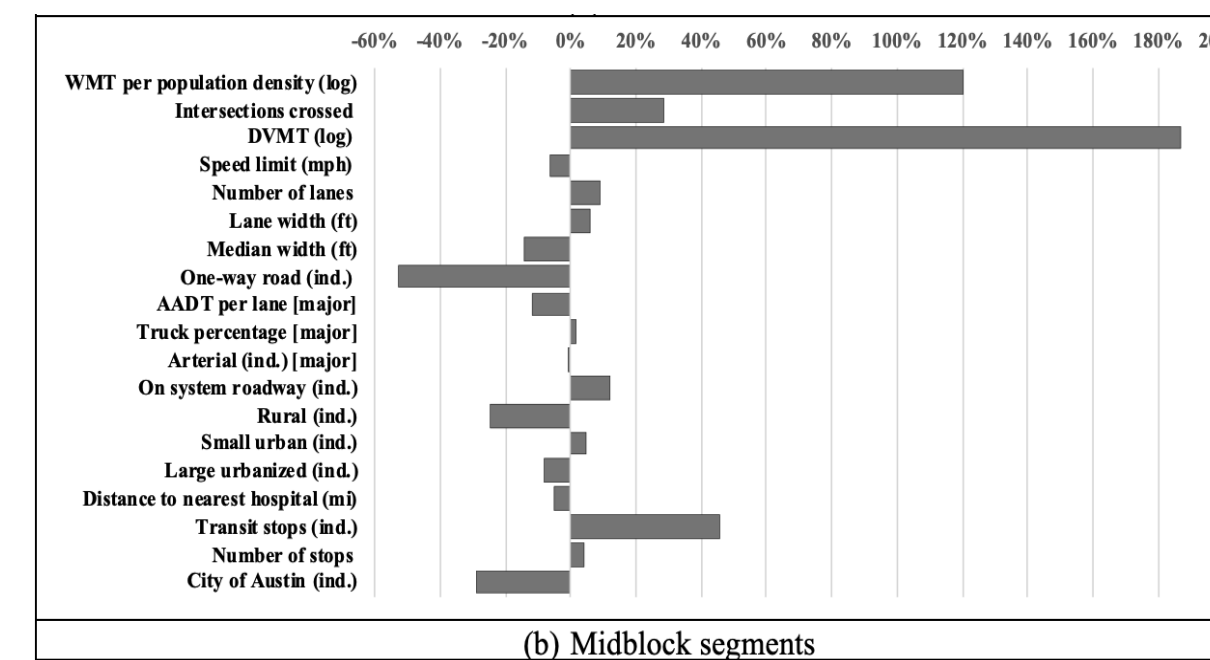
- **Signalized intersections** \Rightarrow **Double # ped crashes** (after controlling for # lanes, local walk mile traveled (WMT), traffic volume, sidewalks, etc.)
- +1 SD on # **Approaches** \Rightarrow +31% ped crashes
- **Higher speed limits lower** ped crash count.
- Ped crashes rise with # lanes, lane widths, traffic volume, and truck %.
- **Ped crashes fall** with 1-way road type, median width, & distance to hospital.
- **Transit stops** increase # ped crashes.
- **Significant increase** when intersection is located in **City of Austin** (rather than elsewhere in Texas). But Austin midblocks seem safer... (see below)



Changes in number of pedestrian crashes when variables are increased by 1 standard deviation (SD)

Mid-block Ped Crashes

- **WMT** has similar effect as intersections.
- +1 SD # **intersections crossed** per 1-mi. segment (2.8) \Rightarrow +29% ped crashes
- **Transit stops** increase ped crash counts
- **One-way** roadways \Rightarrow **Safer** (significant ped crash reduction)
- Significant **decrease** in ped crashes if **midblock segment is in City of Austin** (rather than all of Texas in general).

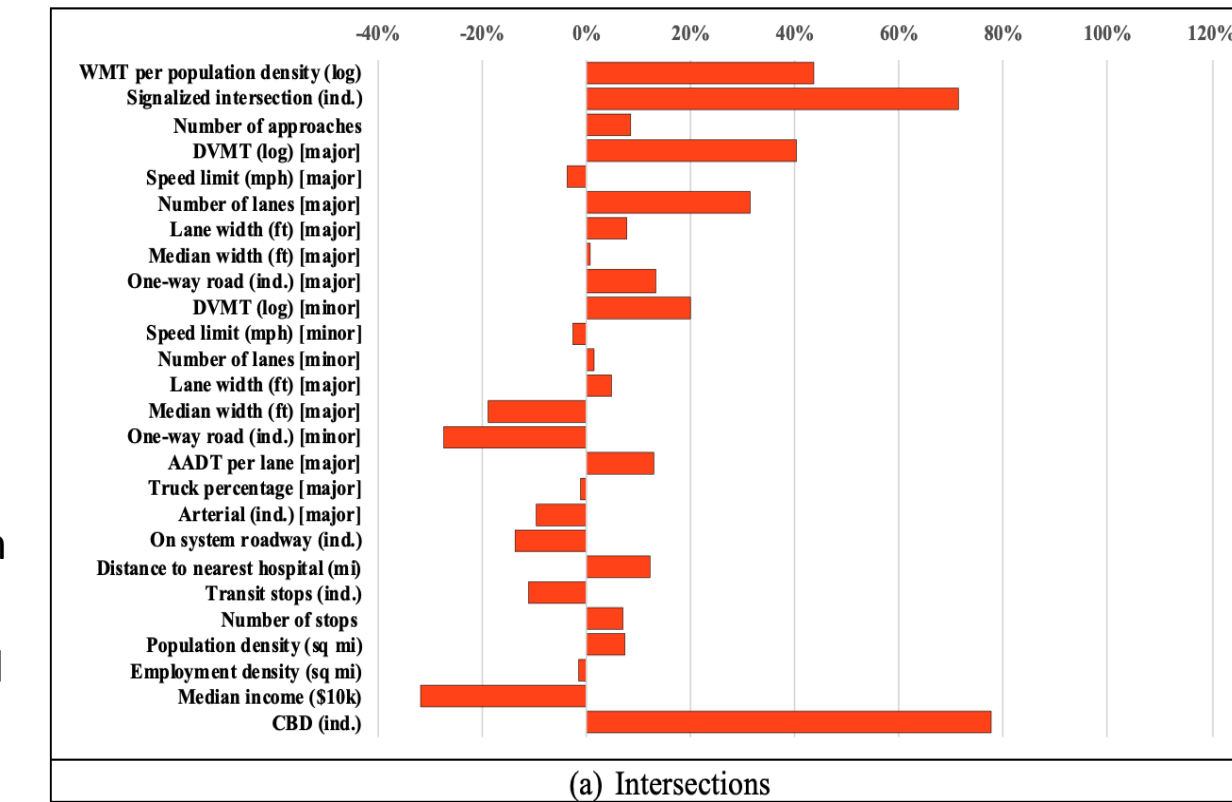


Thanks to RTI project manager Shelley Pridgen, project monitoring committee Carol Campa, Khalid Jamil, Noah Heath, Sharlotte Teague, Solomon Thomas, and Mark Dickerman, Larbi Hanni, & CRIS Support Team

CITY OF AUSTIN

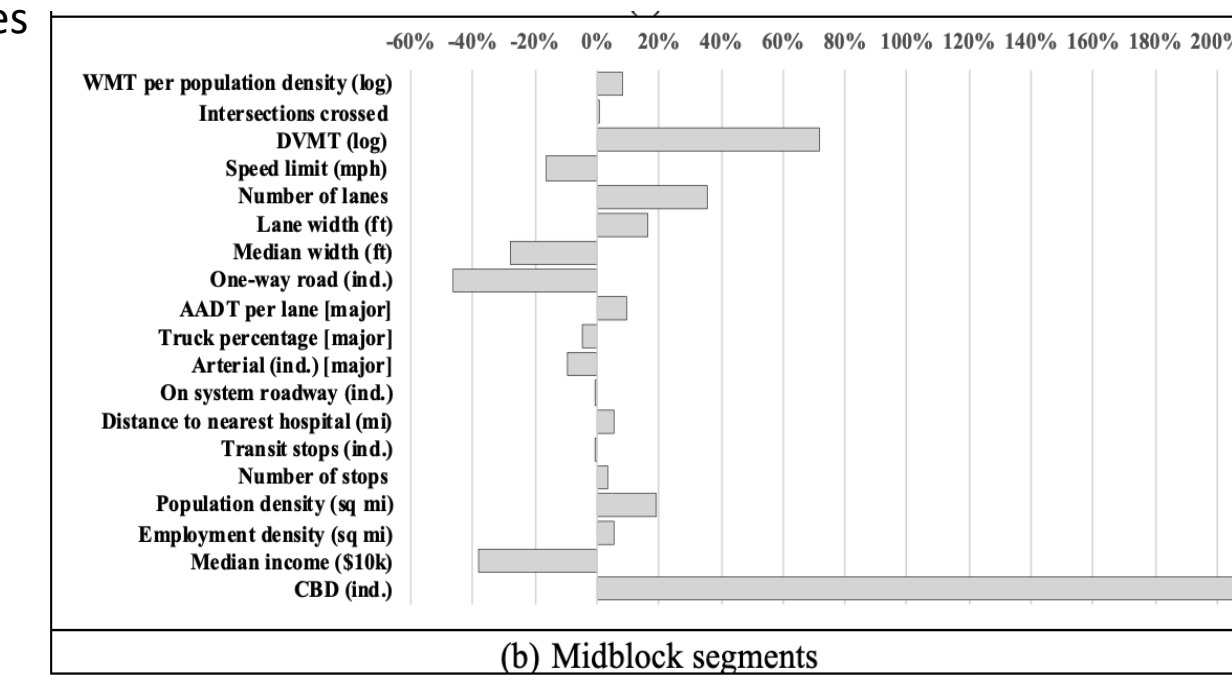
Intersection Ped Crashes

- **Signalized intersections** \Rightarrow less sensitive than Texas model
- +1 SD **population density** \Rightarrow +15% ped crashes
- **Equity concern: +\$41K in average household income** \Rightarrow -32% ped crashes
- Transit stop concern is less in Austin than in the rest of Texas.
- **Central business district (CBD)** \Rightarrow **critical**



Mid-block Ped Crashes

- +1 SD **pop. density** \Rightarrow +21% # ped crashes
- **+\$41K in the avg. household income** \Rightarrow -39% ped crashes
- Ped crashes fall as **lane width** decreases, & **median width** increases
- **CBD** \Rightarrow **critical (+240%)**



Summary & Conclusions

- Pedestrian crash counts predicted for more than **1 million Texas intersections & midblock segments** over 10 years.
- Model results help prioritize treatment locations (by identifying high-risk settings) & identify several types of **cost-effective crash-reducing countermeasures**, like speed reduction, signal timing changes, ped (mid-block) beacon sites, rechannelization, traffic calming, etc.
- Negative binomial model results suggest that **ped crash counts are much higher** at signalized intersections, along arterial roads, with more & wider lanes, narrow or missing medians – ceteris paribus (like annual average daily traffic [AADT]).
- **Midblock segments** are more vulnerable than intersections.
- **Austin** results suggest **CBD locations probably critical** for both intersection & mid-block, with **midblock # rising dramatically (240%)**.
- **Related findings:** Bernhardt et al.'s (2020) county-level work finds **homelessness** to be **serious factor**, & Zhao et al. (2021) & Rahman et al. (2021) show how **light-duty trucks do more harm**, along w/**proximity to schools & transit stops** having higher ped crash counts.