

VISION ZERO

Mapping a path toward improving traffic safety in Costa Rica

Background

Costa Rica's second largest city, Alajuela, experienced 3,734 traffic collisions between 2012-2014.

While the Costa Rica Transport Ministry recently launched mobile phone campaigns encouraging safe pedestrian behavior, traffic fatalities and injuries involving vulnerable users remain a serious concern in not only Alajuela, but throughout Costa Rica (1).

The following analysis attempts to contribute to Costa Rica's traffic safety research by answering 2 questions:

1. At the country level, where do the highest rates of traffic collisions occur?
2. At the city level, specifically Alajuela, which intersections should be prioritized for safety improvements?

Can Vision Zero work in Costa Rica?

Conceptualized in Sweden in the late 1990s, Vision Zero has become a strategy employed worldwide to combat dangerous roadway conditions by reengineering streets (2,3). Cities, like Los Angeles, have created priority network maps to help elected officials prioritize implementation of roadway improvements (4). This kind of mapping tool may be useful for cities in Costa Rica that experience high rates of traffic collisions.



Above image: A social media campaign encouraging pedestrians to use pedestrian bridges (5).

Methods

Costa Rica's Roadway Safety Council, COSEVI, provided 2010-11 countrywide collision data and 2012-14 collision data for Alajuela. COSEVI also provided data for highway infrastructure and political boundaries. Countrywide population data were obtained through the Open Source ArcMap website.



Countrywide Crash Index:

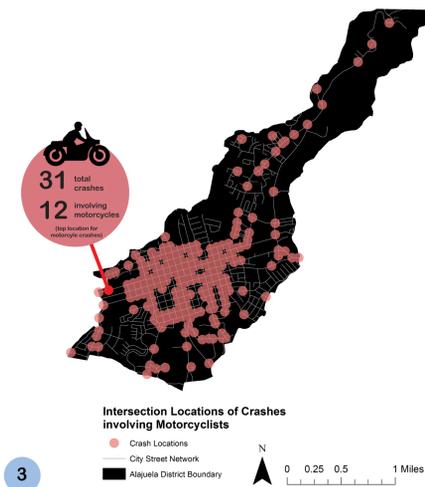
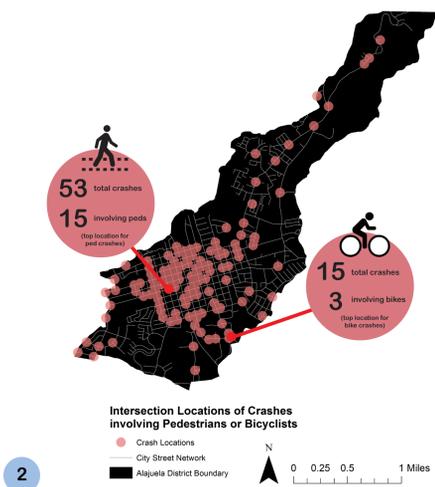
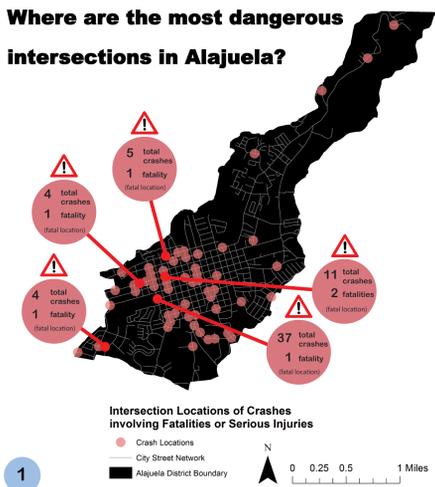
To develop the "Countrywide Crash Index," the following 3 layers were converted to rasters, reclassified 1-5 (low-high number of crashes), and combined using the raster calculator. The combined layer was converted back into a vector where it was joined with population data, so crash rates per district could be evaluated using the Local Moran's I tool:

1. Location of collisions involving pedestrians
2. Location of collisions involving bicyclists
3. Location of collisions resulting in serious injuries or fatalities

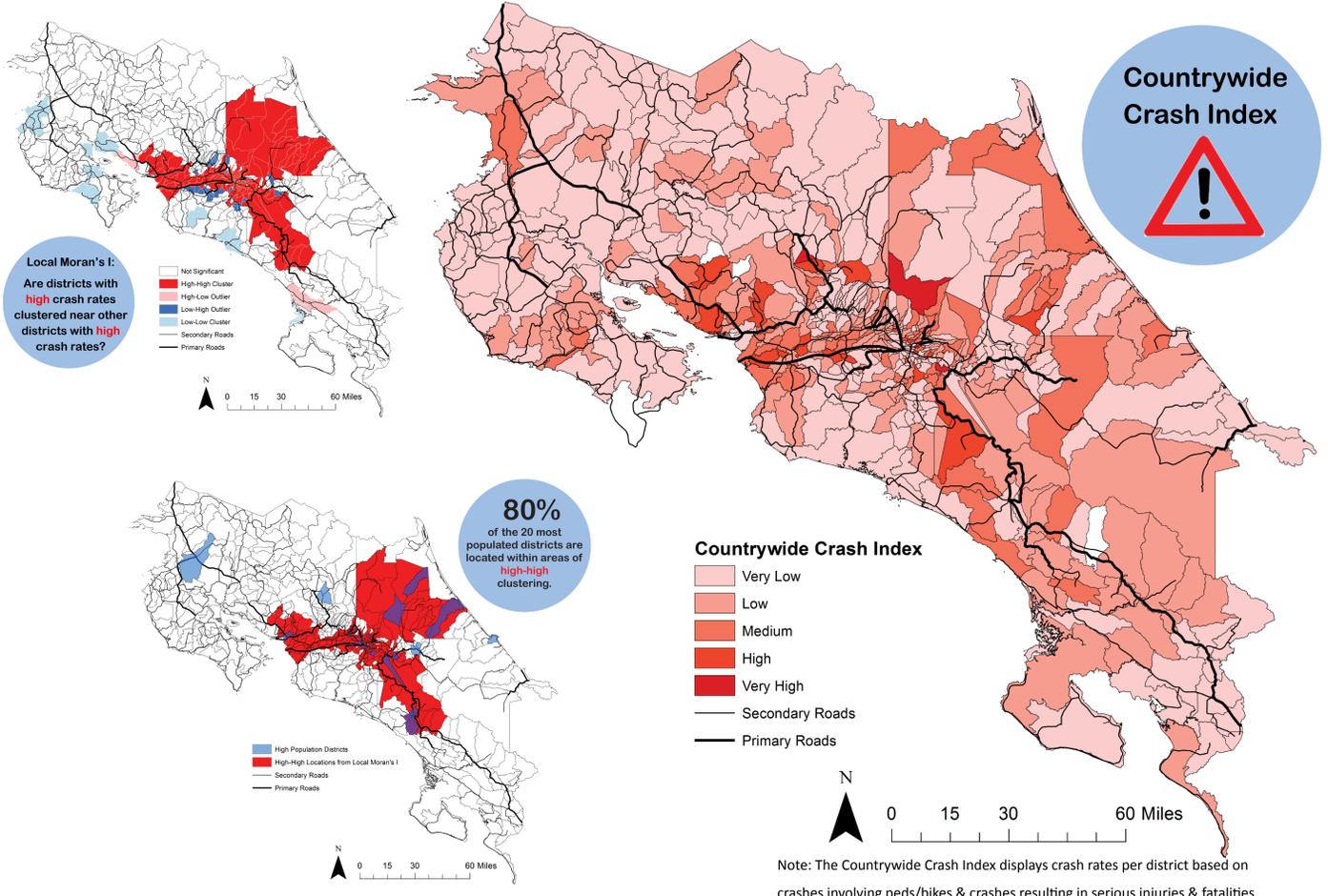
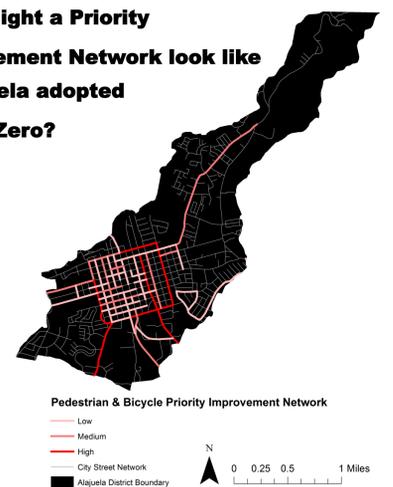
Alajuela's Ped/Bike Priority Improvement Network:

To develop a street network of ped/bike infrastructure improvements in Alajuela, all crash locations were first joined to their closest intersection. Attribute queries were run to create maps 1-3 below, and the final Ped/Bike Priority Improvement Network was created by joining the pedestrian and bicycle crash intersection points to the street grid. Each street was given a sum of all of the crashes at the intersection points intersecting it. Each street was reclassified (low-high) according to number of crashes.

Where are the most dangerous intersections in Alajuela?



What might a Priority Improvement Network look like if Alajuela adopted Vision Zero?

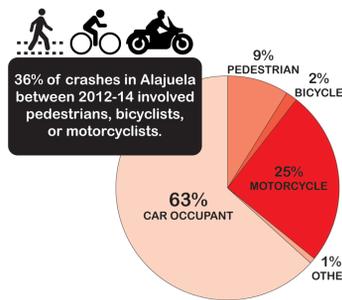


Results

Countrywide, there was consistency between districts with high rates of crashes involving pedestrian and bicyclists and crashes involving serious injuries and fatalities. A Local Moran's I analysis helped identify the clustering of crash rates between districts. The majority of high-high clustering was found in central Costa Rica. Several locations with high crash rates surrounded by locations with low crash rates were found as well. These districts include Palmar, Puerto Cortes, Chomes, and Manzanillo. These locations, however, may experience more traffic as a result of primary and secondary road infrastructure. 16 of the 20 highest population centers were located within high-high clustered districts, which means that larger districts, even when controlling for population in the Moran's I analysis, are likely located near districts that also contain high rates of crashes. Smaller population centers surrounding larger cities may have high rates due to traffic that flows between urban and rural areas.

At the local level,

the distribution of crashes involving pedestrians and bicyclists was fairly similar to the distribution of crashes involving motorcyclists as well as serious injuries and fatalities. There is a high concentration of crashes in Alajuela's center street grid, which is further demonstrated in the "Pedestrian and Bicycle Priority Improvement Network."



Conclusion

While traffic crashes occur across the entire country, the central portion of Costa Rica experiences the highest rates of crash clustering. At the local level, Alajuela, is particularly vulnerable to crashes and lies within the clustering of districts that contain high rates of traffic collisions. Peds/bikes are at the greatest risk of being involved in crashes in the district's urban core. This may be the result of these locations also containing the highest percentage of peds/bikes. More data collection on pedestrian and bicycle-use within Alajuela is needed to fully understand this relationship.

While the Ped/Bike Priority Improvement Network helps narrow Alajuela's focus on where to prioritize intersection infrastructure improvements for vulnerable users, the network does not account for other factors, such as location of schools or hospitals. In accord with the principles of Vision Zero, Alajuela may want to incorporate additional variables into this analysis to further identify intersections that merit timely safety improvements.

References

1. L. Arias, "Pedestrian Fatalities in Costa Rica Currently Outnumber Drunk Driving Deaths," *The Tico Times News*, last modified May 27, 2015, <http://www.ticotimes.net/2015/05/27/pedestrian-fatalities-costa-rica-higher-drunk-driving-deaths-first-four-months>.
 2. Michelle Birdsall, "All Roads Lead to Zero: Realizing Vision Zero," *Institute of Transportation Engineers ITE Journal* 86, no. 4 (2016): 26-28.
 3. Roger Johansson, "Vision zero - implementing a policy for traffic safety," *Safety Science* 47, no. 6 (2009): 826-31.
 4. "Vision Zero Los Angeles: A Data Driven Approach," *Vision Zero Los Angeles*, 2016, <http://visionzero.lacity.org/>.
 5. L. Arias.
- Clip Art Images: ctker.com (warning sign and bike), downloadclipart.net (pedestrian), images.clipartpanda.com (motorcycle).
- Projected Coordinate System: Proyección CRTM05
Projection: Transverse Mercator