

# Improving Pedalcyclist and Pedestrian Safety in Olympia, WA

Olympia, WA offers an excellent quality of life, especially in terms of transportation options for a city of about 50,000 residents. According to the Olympia Bicycle Master Plan, there are 42 miles of bike lanes and trails in the city, and over 50% of its streets are lined with sidewalks. All things considered, Olympia seems like a safe place to live with excellent human-powered transportation infrastructure. However, data provided by the Washington State Department of Transportation reveals that there have been nearly **700 reported collisions in the last 10 years** between motor vehicles and pedestrians/cyclists. To put that number in perspective, a resident of Olympia is more than twice as likely to be hit by a car when walking or riding a bike than they are of being a victim of robbery or rape. There have been **5 fatal collisions in the last 10 years**, meaning Olympia's residents are about as likely to be murdered as they are to be killed by a car when walking or cycling. With statistics like that, pedestrian and pedalcyclist safety is a seriously underfunded public safety issue, with just \$500k a year spent on facilities, trying to make a dent in an \$80 million backlog of needed improvements. This project looks for solutions to reduce the injuries and fatalities of pedestrians and pedalcyclists, using available research literature and new geospatial analysis, in an effort to determine where best to spend the city of Olympia's limited resources with an emphasis on safety.

The data provided by the Washington State Department of Transportation reveals the following general information about accidents in Olympia:

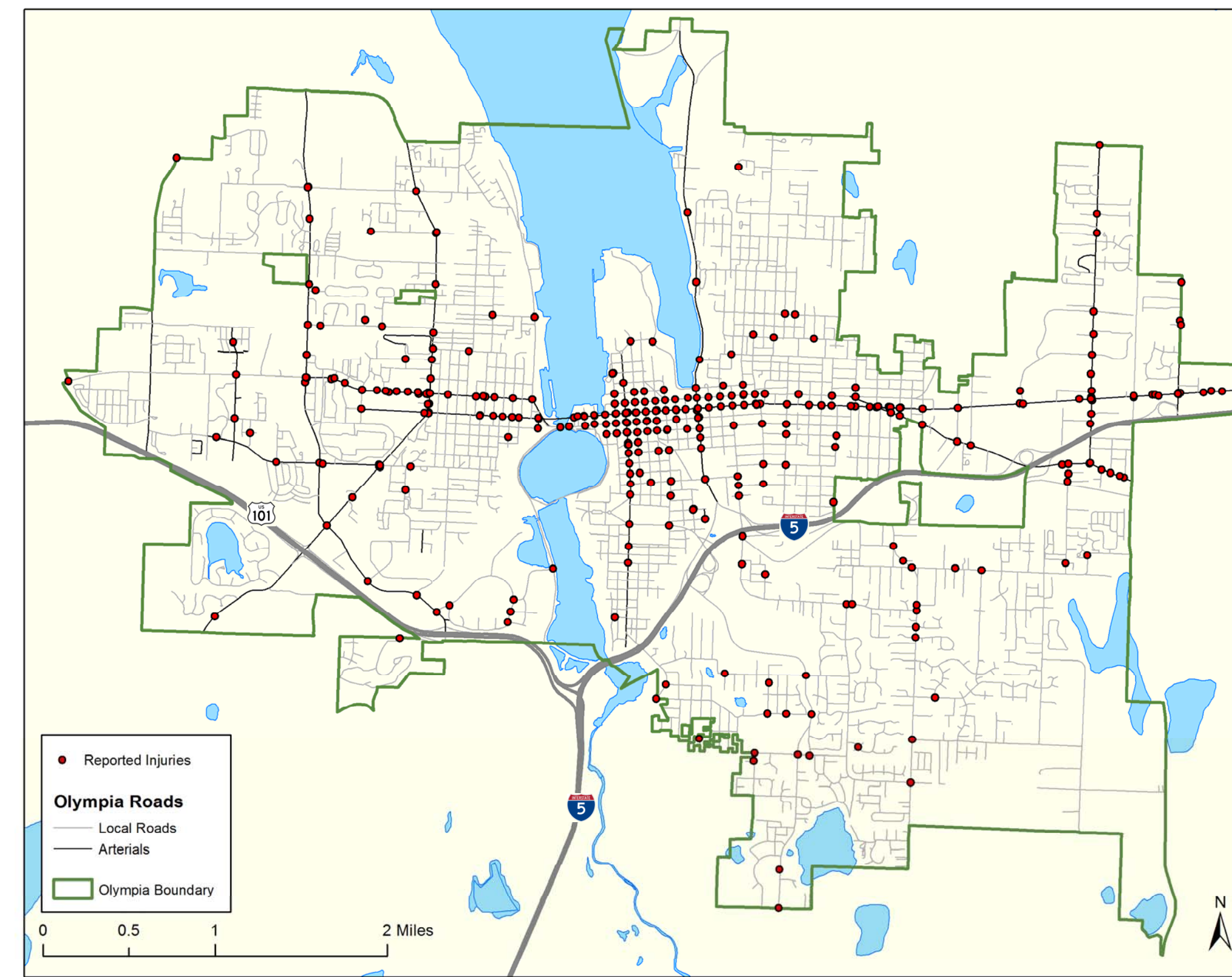
- Numerically, more pedalcyclists are hit by automobiles, although resulting in less-severe injuries
- Fewer pedestrians are hit by automobiles, but with more-severe injuries
- **Most collisions with pedestrians/cyclists occur at intersections**, and during the day

On the near right, a simple plotting of the collisions shows a fairly dense grouping in Olympia's downtown area (east of the Puget Sound). Viewers will also notice a line of collisions, running along 4<sup>th</sup> Ave from the west side of town to the east.

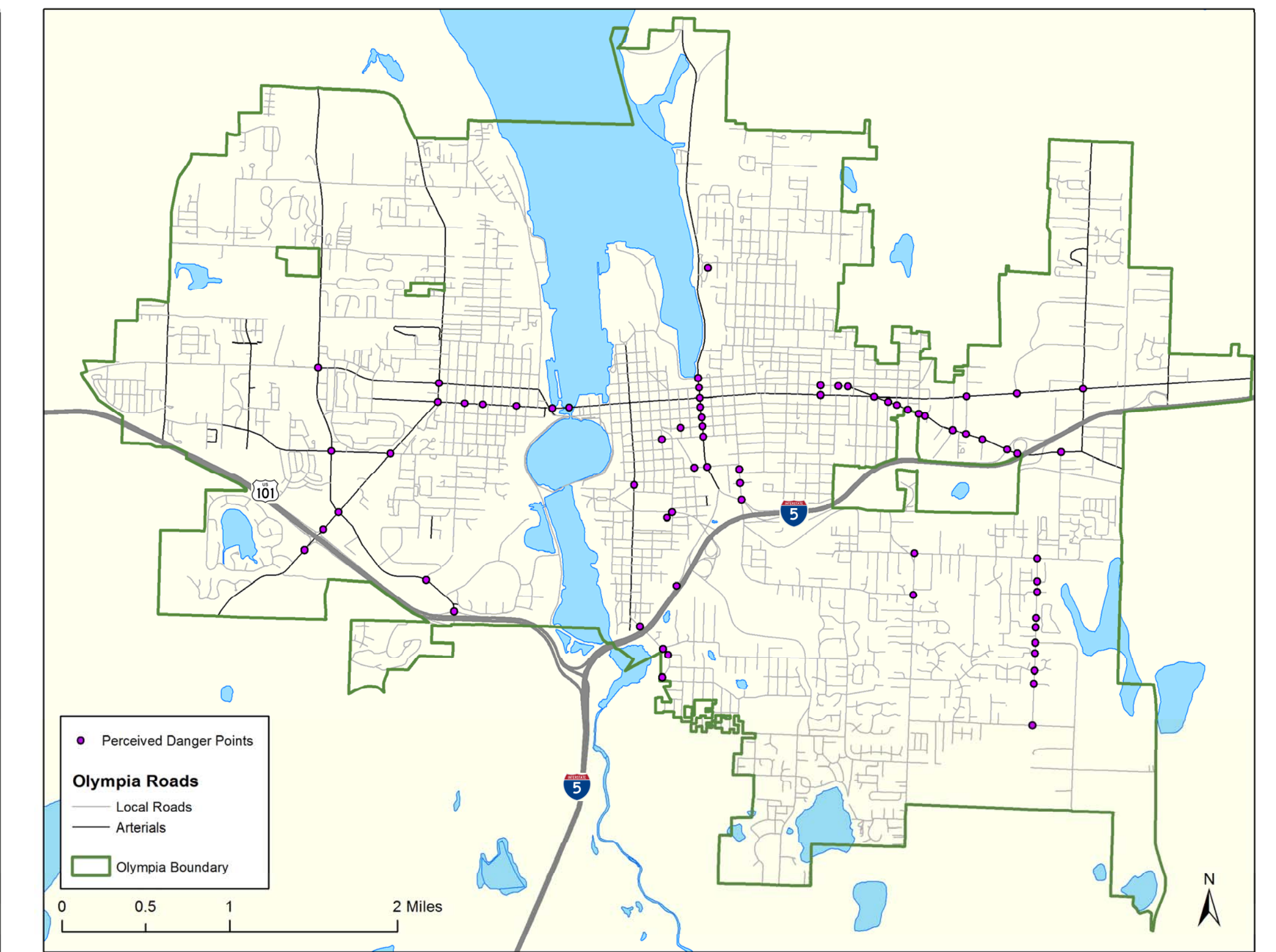
Supporting literature for this kind of safety study is best exemplified by Schneider, Ryznar, & Khattak's 2004 journal article *An Accident Waiting To Happen: A Spatial Approach To Proactive Pedestrian Planning*. In this article, the authors look at reported collision data, but also realize that official collision data doesn't tell the whole picture of a city's safety landscape. People underreport, and the data are clearly affected by citizen behaviors (avoiding certain areas, choosing particular paths, etc.). To get a better idea of how people interact with the human-powered transportation environment, the authors asked participants to map perceived dangerous areas on a map. These "perceived danger points" were then weighted and added to the reported data to give a richer picture of the safety of the college campus in question.

For this project, a survey was conducted to collect this kind of "user data." Cyclists and pedestrians from Olympia were asked to mark on a map areas of the city that made them feel unsafe. While not a scientifically-conducted survey, the results were interesting. On the far-right, viewers can see the results. There were 86 responses, and the points are fairly spread out around the city. There is no clear overlap of the reported data and the user data upon initial inspection.

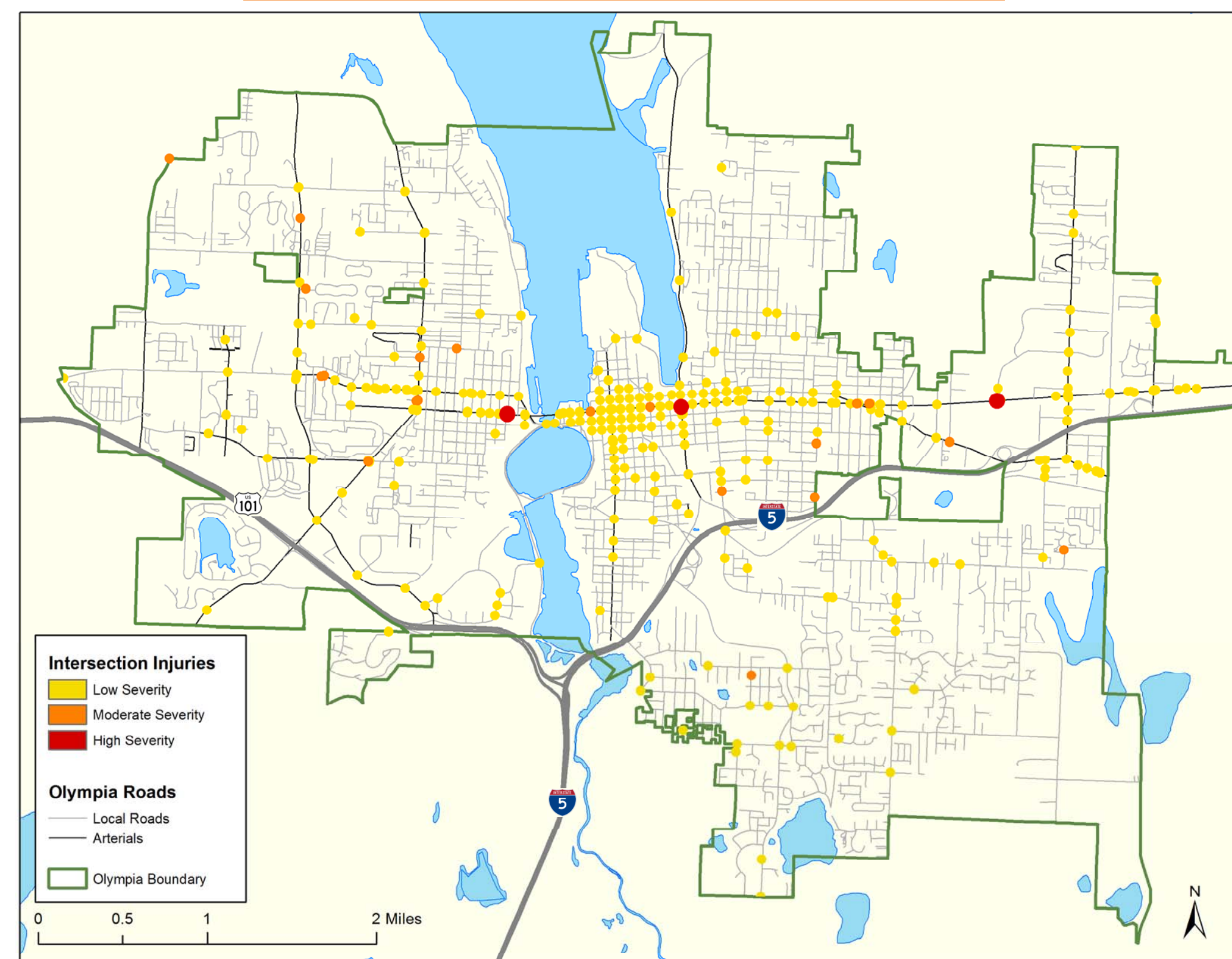
Reported Injuries In Olympia



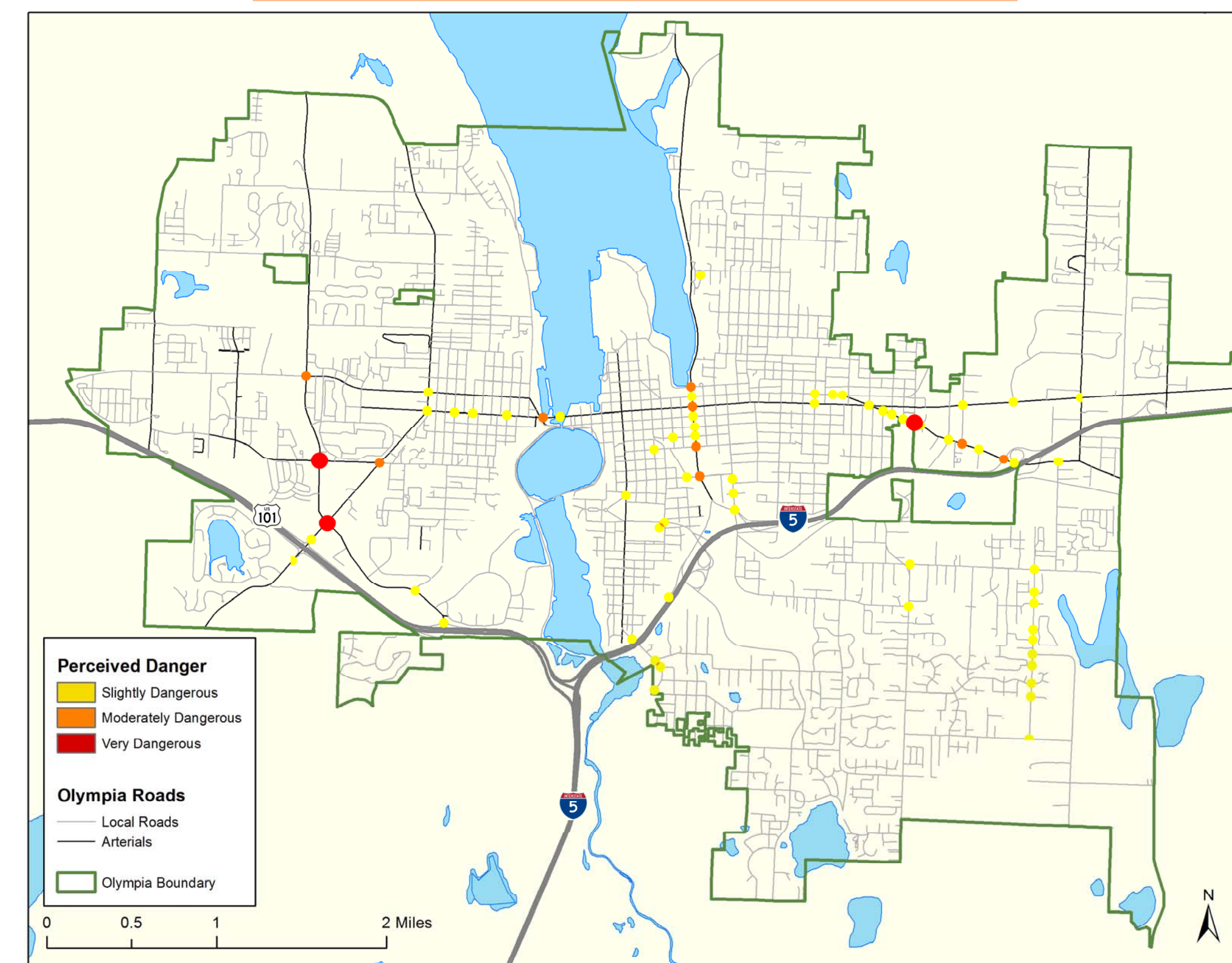
Perceived Danger In Olympia



IDW Weighted Reported Intersections



Point Density Perceived Intersections



In order to make sense of this data, a series of analyses were conducted to group the points, weight them, and determine the most severely dangerous intersections. The statistical tools available in ArcGIS were IDW (Inverse Distance Weighted), Kernel Density Analysis, Hot Spot Analysis (Getis-Ord Gi\*), and Point Density Analysis. All of the analysis tools were run on both sets of data (reported and perceived) to find out which method best grouped and weighted the data points.

The reported accident data came with 'severity' information, rating the nature of the injuries to pedestrians and pedalcyclists. In order to analyze this information, the textual severity descriptions were converted to numbers, weighted as follows on a ranking scale:

Severity	Numeric Score
No Injury	1
Possible Injury	2
Evident Injury	4
Serious Injury	6
Fatal Injury	10

IDW and Kernel Analysis both allow for weighting, and essentially came up with the same results, which were superior to the results of the Hot Spot Analysis tool. IDW was ultimately chosen because of the superior visualization options. On the far-left, viewers can see a map showing the "most dangerous intersections" in Olympia, weighted by the severity of injuries to a combination of pedestrians and pedalcyclists.

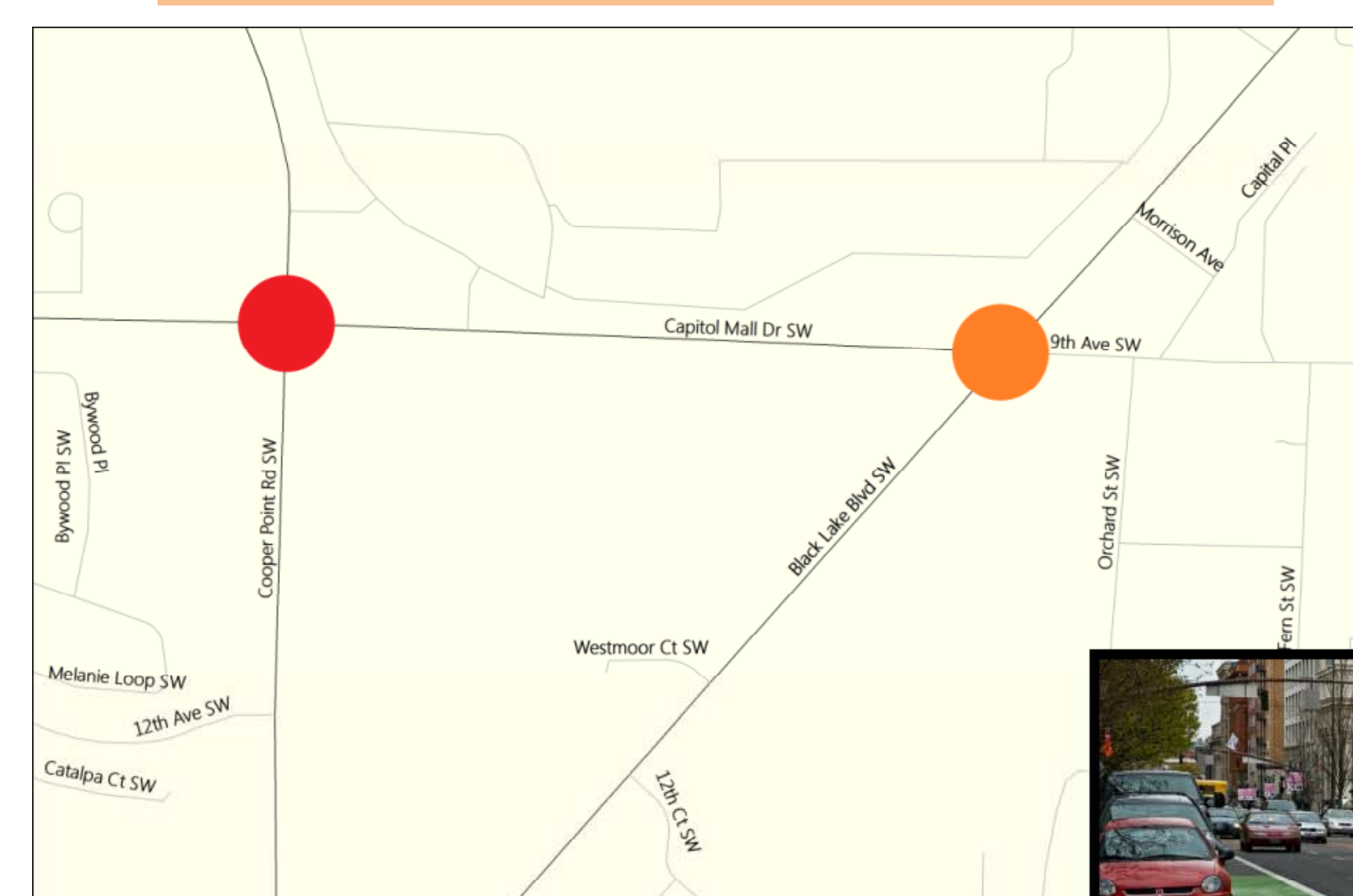
Unfortunately, the citizen-generated "perceived" data did not have a severity ranking. As such, IDW and Kernel Analysis were no better than a more simple Point Density analysis in grouping and visualizing the points. Since it's an apples to oranges comparison, the reported data and "perceived data" analyses are on different maps. Viewers can compare the danger points side-by-side and see that there is some, but not numerous, overlap. However, this result lends itself to some further analysis.

Comparing the "IDW reported results" with the "Point Density perceived results" is an apples to oranges evaluation, but there is clearly a connection between the two: citizen behavior. Collisions go up in areas with high traffic counts, and pedestrians and cyclists avoid areas with heavy auto use. Therefore, normalization of the "perceived data" with its own "severity" index is possible, basing the normalization on measured traffic counts from the city of Olympia. After normalizing, using the raster calculator to combine the perceived data and the reported data yields meaningful results.

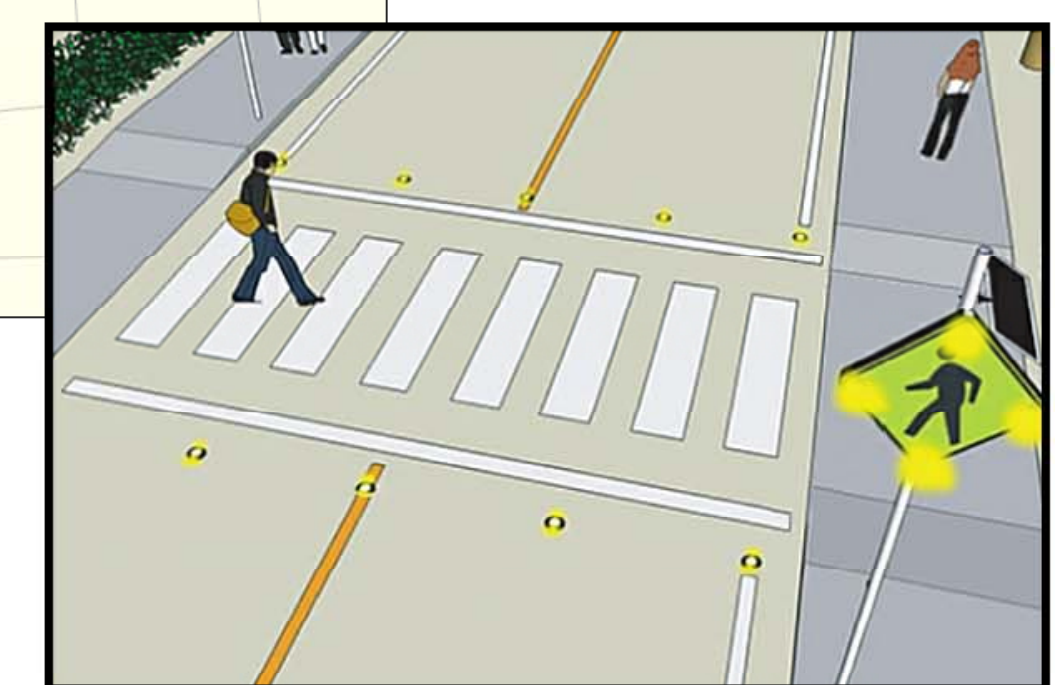
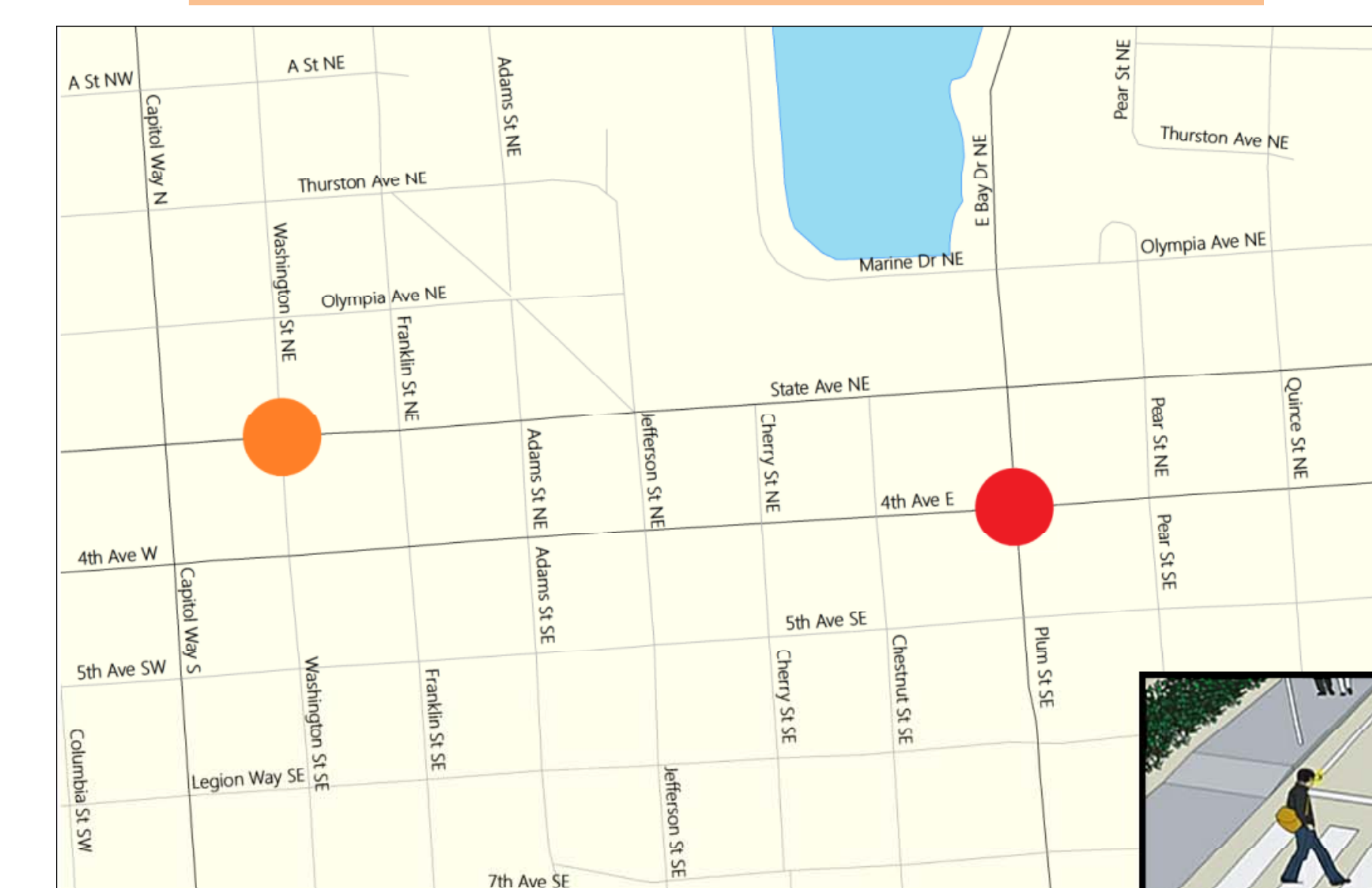
For this final part of the analysis, the reported data was split into individual pedestrian and pedalcyclist groups. These point sets had an IDW applied, and the resulting rasters were combined with the traffic-count normalized perception data. The final rasters revealed dangerous intersections, in terms of a combination of reported and perceived danger. The near-right map shows the two most dangerous intersections in Olympia for cyclists, red being the most dangerous and orange representing runner-up (both are found on Capitol Mall Drive). The far-right map shows the two most dangerous intersections in Olympia for pedestrians (both are in the downtown corridor on main, 1-way thoroughfares).

The data show that intersections are the biggest problem in Olympia in terms of pedestrian and pedalcyclist safety. However, the city of Olympia's Comprehensive Plan does not address intersection safety in its plans for adding facilities for pedestrians and cyclists, rather focusing only on sidewalks and bike lanes. For the purposes of this project, intersection safety solutions were considered. Taking into account the road type for the problem intersections, traffic calming wasn't an option (speed limits are already at a minimum, and these are main thoroughfares not conducive to physical barriers). Therefore, non-traditional facilities were considered. For cyclists, a road-paint "bike box" that allows cyclists to queue ahead of cars at traffic lights is the best way to reduce injuries at intersections. For pedestrians, lighted signs and embedded, flashing road markers is the best method for alerting drivers. An example of both these solutions can be found bottom-right of their respective maps.

Most Dangerous Pedalcyclist Intersections



Most Dangerous Pedestrian Intersections



## Acknowledgements:

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Research literature inspiration - Schneider, Ryznar, & Khattak. (2004). An Accident Waiting To Happen: A Spatial Approach To Proactive Pedestrian Planning. *Accident Analysis & Prevention*, 36 (2), 193.

Guidance by Dr. Matthew Kelley

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