Manhattan Intersection Geometry is Related to Crash Frequency and Severity

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Understand Intersection Geometry to Prevent Vehicle Crashes

In Manhattan, an average of 72 vehicle crashes happen per day, from crash data collected from 2012 to 2024 (Motor Vehicle Collisions - Crashes | NYC Open Data, n.d.). Analyzing factors vehicle crash factors helps us better understand how to prevent them. This allows us to prevent harm and loss of life from crashes in the future.

Intersection geometry is one factor that potentially contributes to the likelihood and severity of a crash. This analysis classified intersections as one of two categories - perpendicular or skewed. Perpendicular intersections were defined as 90 degrees, with a tolerance of 10 degrees (Figure 1, left). Intersections that did not meet the perpendicular definition were classified as skewed (Figure 1, right).

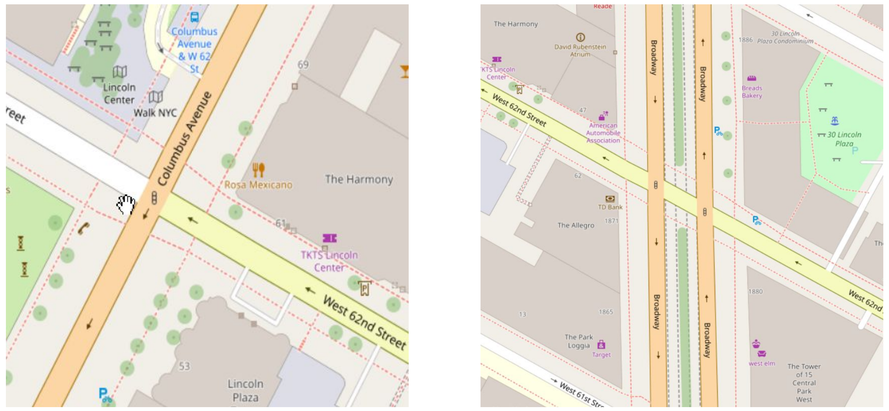

Figure 1. Example of a perpendicular intersection (left) and skewed intersection (right).

Calculating Intersection Angles

NYC Street Centerline data and GeoPandas were used to calculate geometric features of intersections. Street geometries were overlaid with itself to find intersections. Then the angle between intersecting roads was calculated by finding the angle between the line geometries the composed each intersection. Angles within 10 degrees of 90 were classified as perpendicular. The angle was classified as skewed otherwise. Finally, crashes within 1 CRS unit of an intersection were joined to the nearest intersection.

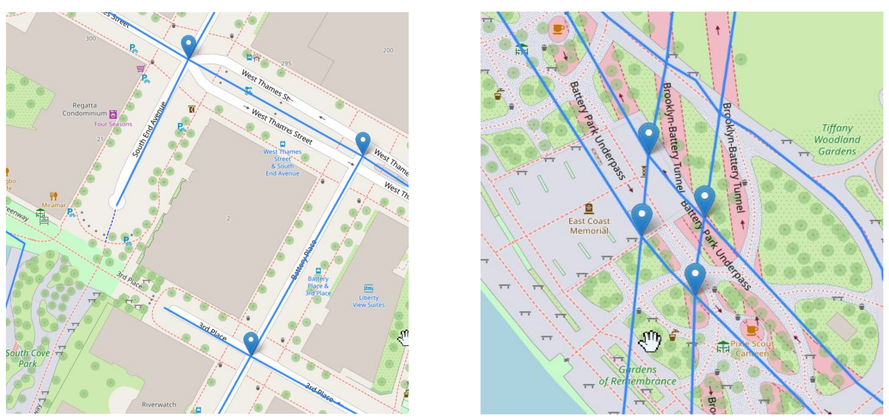

Figure 2. The angle of intersection between line geometries (NYC streets) was calculated.

Perpendicular Intersections Have Higher Crash Rates

The number of crashes that occurred at each intersection type was divided by the number of each intersection type respectively to obtain the overall rate of crashes occurring per intersection type. Similarly, the number of crashes with at least one fatality was used to calculate the rate of fatal crashes. The same method was applied to number of crashes that had at least one injury, and number of crashes with no fatalities or injuries. Results indicate that perpendicular interactions had a higher crash rate in all calculated categories.

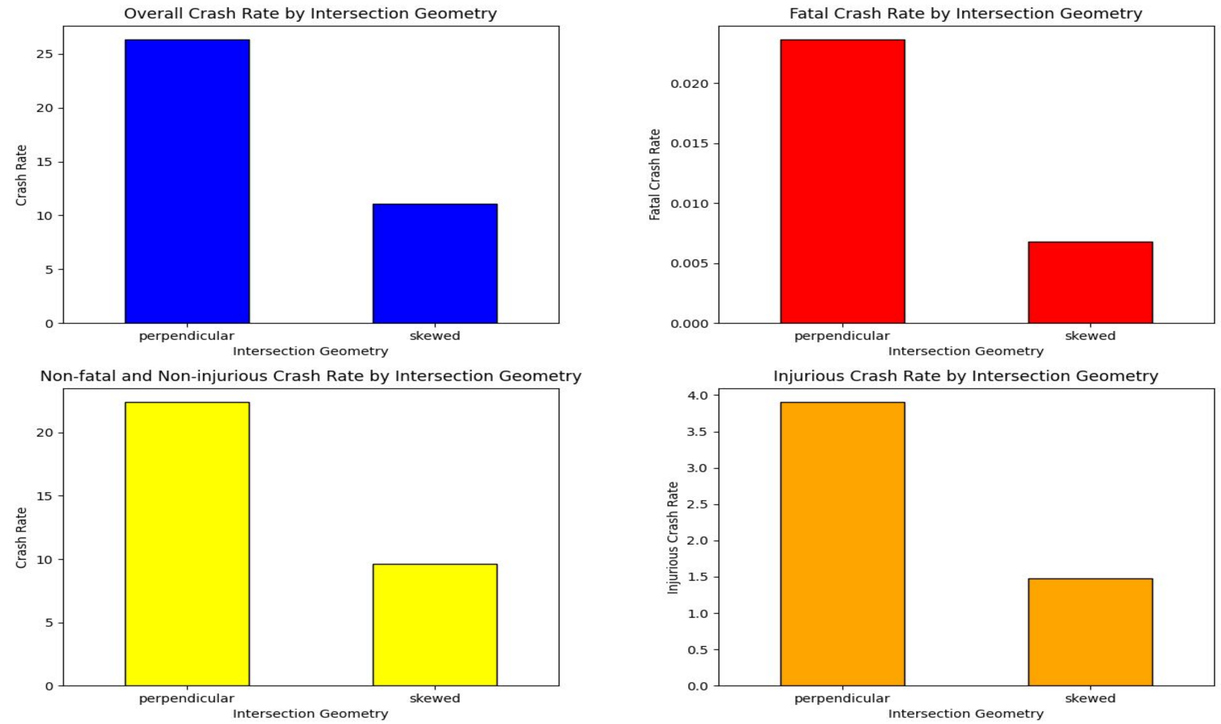

Figure 3. Clockwise from top left: overall crash rate by intersection type, fatal (one or more fatalities) crash rate by type, injurious (no fatalities, but one or more injuries) crash rate by type, and non-fatal, non-injurious crash rate by intersection type.

Perpendicular Intersections Have Higher Crash Rate Than Skewed

To improve road safety, attention could be focused on perpendicular intersections because the data indicate crashes happen at a higher rate there. Possible solutions include adding traffic calming features like raised crosswalks and increasing surveillance to discourage unsafe driving. Notably, these results differ from Federal Highway Administration findings (Federal Highway Administration, 2021).

References

Impact of Intersection Angle on Highway Safety , January 2021 - FHWA-HRT-20-067. (2021). Retrieved November 9, 2024, from https://www.fhwa.dot.gov/publications/research/safety/20067/index.cfm

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