OTIS
Office of Transportation,
Infrastructure, & Sustainability
CITY OF PHILADELPHIA

Memorandum

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Date: 04 February, 2022

Re: *Updated Washington Avenue Crash Trends*

Overview

This document provides an overview of trends identified in the City of Philadelphia's Washington Avenue Crash Analysis, updated January 2022. The goal of this document is to:

1. summarize the crash data for Washington Avenue between Gray's Ferry Avenue and 4th Street for the years between and including 2016 and 2020;

2. review prominent crash trends, particularly those impacting vulnerable users (people walking and people riding bicycles) on Washington Avenue;

3. summarize the tools and strategies that could prevent crashes or lessen crash severity on Washington Avenue if implemented.

Summary of Key Findings

1. **Vulnerable users – people walking and people riding bicycles – are overrepresented in crashes on Washington Avenue compared to Philadelphia County.** Improvements on Washington Avenue should prioritize strategies specifically targeted towards improving conditions for these vulnerable users.

2. **Addressing left turns onto Washington Avenue from minor approaches must be a primary strategy to reduce pedestrian crashes**. Lane reductions and protected bicycle lanes on corridors like Washington Avenue have been shown to reduce pedestrian (and bicycle) injury

and KSI related to these kinds of left turn crashes.[1, 2]

3. Red light running caused 25% of all crashes at intersections and 36% of all angle crashes at intersections. Automated red light cameras along Washington Avenue could help enforce adherence to traffic signals.

4. Slowing motor vehicle turns and separating bicycles from motor vehicles could prevent reported bicycle crashes on Washington Avenue between Grays Ferry Avenue and 4th Street[2]. In addition, improved bicyclist adherence to traffic controls and regulations might have prevented 33% of reported bicycle crashes. Existing conditions often function as a 'shared lane,' a high-stress environment in which people driving and people riding bicycles negotiate and compete for shared space. Installation of high-quality bicycle facilities has been shown to increase bicycle compliance to traffic controls and reduce sidewalk riding.[3] Installation of protected bicycle lanes is also projected to increase bicycle volume on Washington Avenue, which has been shown to increase bicyclist adherence to traffic controls and regulations.[4]

5. Midblock crashes are a problem on Washington Avenue. Specifically, illegal U-turns account for 38% of reported midblock crashes on Washington Avenue.

Data

The Office of Complete Streets (OCS) performed initial crash analysis for Washington Avenue in 2019 using PennDOT crash data for the years 2012 to 2018. This date range was chosen because it roughly corresponded to the amount of time between previous Washington Avenue redesign public discussions and the beginning of analysis.

The updated analysis presented in this document uses CRASH, FLAG, VEHICLE, and PERSON data for crashes on Washington Avenue between Grays Ferry Avenue and 4th Street for the years 2016 through 2020.

Crash data for the City of Philadelphia was downloaded from the PennDOT Crash Information Tool (PCIT). Data for all years between and including 2012 to 2018 was downloaded for the previous analysis. Data for 2019 and 2020 was appended to the 2012 to 2018 data in R Studio using R version 4.1.2 (2021-11-01) using the *dplyr* and *janitor* packages. The resulting data consisted of 308 crashes on Washington Avenue within the project extents for all years between and including 2012 and 2020.

1 New York City Department of Transportation, *Don't Cut Corners: LEFT TURN Pedestrian & Bicyclist Crash Study*, August 2016. https://www1.nyc.gov/html/dot/downloads/pdf/left-turn-pedestrian-and-bicycle-crash-study.pdf

[2] U.S. Department of Transportation Federal Highways Administration. Road Diet Informational Guide, November 2014. https://safety.fhwa.dot.gov/road_diets/guidance/info_guide/rdig.pdf

[3] Furth, Dulaski, Bergenthal, and Brown. "More Than Sharrows: Lane-Within-A-Lane Bicycle Priority Treatments in Three U.S. Cities." Presented at the 2011 Annual Meeting of the Transportation Research Board, January 2011. http://www1.coe.neu.edu/~pfurth/Furth%20papers/2011%20Bicycle%20Priority%20Lanes%20(Furth,%20others)%20TRB%20annual%20mtg.pdf

[4] Tuckel, P., Milczarski, M., "Bike Lanes + Bike Share Program = Bike Safety: An Observational Study of Biking Behavior in Lower and Central Manhattan." Hunter College, the City University of New York, January 2014. http://silo-public.hunter.cuny.edu/62eaab1fad6c75d37293d2f2f6504a15adacd5c6/Cycling_Study_January_2014.pdf

Data for 2016, 2017, 2018, 2019, and 2020 were isolated from the full data and used for the analysis presented in this document.

Iterative checks over the course of the analysis resulted in the removal of several crashes that were included in the original data. In all cases, these crashes were captured by the GIS buffer initially used to isolate crashes on Washington Avenue but, upon close analysis, were determined to have occurred on side streets.

The final 2016 to 2020 Washington Avenue crash data analyzed in this document consists of 169 individual crash occurrences.

1. Crash Analysis Summary
Washington Avenue compared to Philadelphia County

F1. Crashes involving Vulnerable Users, Washington Avenue & Philadelphia 2016 to 2020

Source: PennDOT PCIT for years 2016 through 2020, accessed December 2021
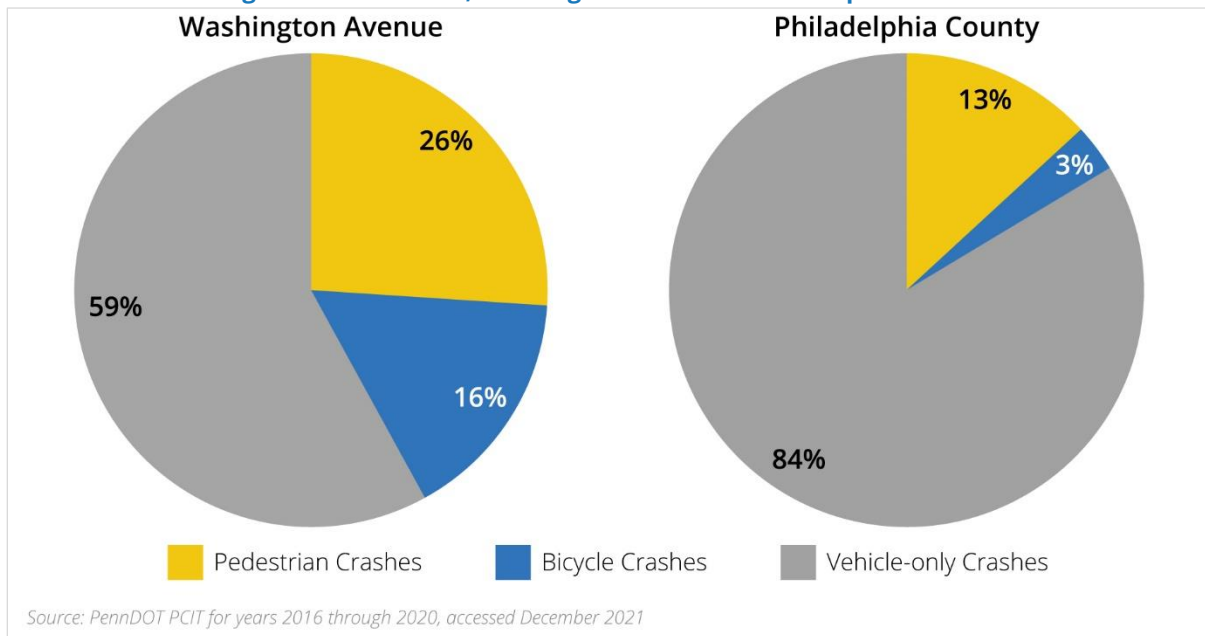
Figure 1, above, compares all crashes on Washington Avenue between Grays Ferry Avenue and 4th Street to all crashes in Philadelphia County for the years 2016 through 2020. **Figure 1 clearly shows that vulnerable roadway users (people walking and people riding bikes) are overrepresented in crashes on Washington Avenue compared to the city overall.**

Washington Avenue experiences 13% more pedestrian crashes and 13% more bicycle crashes than Philadelphia as a whole. This discrepancy indicates a problem specific to Washington Avenue and highlights the need to examine these types of crashes carefully. That careful examination is

summarized in . First, however, this document presents a high-level overview of Washington Avenue crashes to place closer analysis in context.

Crashes by Year

Table 1 breaks all Washington Avenue (Grays Ferry Avenue to 4th Street) crash data down by year. There has been a general decrease in total number of crashes per year from 2016 to 2020. The average (mean) number of crashes across all five (5) years is 33.8, and the median is 32. The relative standard deviation is 27%, which is well within an acceptable standard of variability. In short, although there was a drop in the number of crashes in 2019, no single year appears to be an outlier compared to any other year.

T1. Washington Avenue Crashes by Year

Total Crashes	169	100%
2016	47	28%
2017	37	22%
2018	32	19%
2019	22	13%
2020	31	18%

Type of Crash by Year

Breaking crashes on Washington Avenue down by type – Pedestrian, Bicycle, and Vehicle-only – reveals three (3) general trends:

- The number of pedestrian crashes *increased* by 71% from 2016 to 2020.
- The number of bicycle crashes *decreased* by 80% from 2016 to 2020.
- The number of vehicle-only crashes *decreased* by 43% from 2016 to 2020.

Tables for this data are included in the at the end of this document.

Except for the rise in pedestrian crashes, these general trends are positive. Yet, as demonstrated by Figure 1, vulnerable users are still overrepresented in crashes on Washington Avenue compared to the City of Philadelphia. We must therefore perform more granular analysis rather than take these general trends at face value.

Injury Severity by Type of Crash

Breaking crashes on Washington Avenue down by type – pedestrian, bicycle, and vehicle-only – and injury severity reveals the following:

- 77% of reported pedestrian crashes on Washington Avenue between 2016 and 2020 resulted in a fatality, suspected serious injury, suspected minor injury, or possible injury.
    - 12% of pedestrian crashes are classified as KSI.
    - Two (2) pedestrian crashes resulted in at least one (1) fatality.

- 70% of reported bicycle crashes on Washington Avenue between 2016 and 2020 resulted in a fatality, suspected serious injury, suspected minor injury, or possible injury.

- o 3% of bicycle crashes are classified as KSI.
- o Zero (0) bicycle crashes resulted in at least one (1) fatality.

- 54% of vehicle-only crashes on Washington Avenue between 2016 and 2020 resulted in a fatality, suspected serious injury, suspected minor injury, or possible injury.
  - o 2% of vehicle-only crashes are classified as KSI.
  - o One (1) vehicle-only crash resulted in at least one (1) fatality.

Tables for this data are included in the Appendices at the end of this document.

Taken together, these numbers demonstrate that **crashes of all types involving all road users on Washington Avenue are more likely to result in an injury than not result in an injury.** This is especially the case with crashes involving vulnerable users but is also apparent with vehicle-only crashes.

2. Trends Identified in Analysis

Detailed analysis of pedestrian, bicycle, and vehicle-only crashes involved reviewing individual crash resumes for each crash (provided by PennDOT District 6-0) in combination with CRASH, FLAG, PERSON, and VEHICLE data retrieved from PCIT. Crashes were also mapped in ArcGIS ArcMap 10.8.1 for spatial analysis as needed.

This section describes the prominent crash trends on Washington Avenue between 2016 and 2020. This descriptive analysis is broken down by **pedestrian crashes, bicycle crashes, and vehicle-only crashes.** Each of these three crash categories includes an overview of the primary trends identified in this analysis.

Pedestrian Crashes
This analysis identified the following trends for reported pedestrian crashes on Washington Avenue between 2016 and 2020:

- 77% of pedestrian crashes occurred at intersections.
  - o 82% of pedestrians struck by vehicles at intersections were in a marked crosswalk at the time of the crash.

- 57% of pedestrian crashes at intersections involved turning vehicles.
  - o 34% occurred when a vehicle made a left turn *from* a cross street *to* Washington Avenue and struck a person walking.
  - o 25% occurred when a vehicle traveling straight along Washington Avenue struck a person walking.
  - o 16% occurred when a vehicle traveling along Washington Avenue turned *from* Washington Avenue *to* a cross street and struck a person walking.

- 23% of pedestrian crashes occurred at mid-block locations.

- o 18% of pedestrians struck by vehicles mid-block were located somewhere in the roadway at the time of the crash.

- 57% of pedestrian crashes were attributed to driver actions:
  - o 30% were attributed to a driver making an improper/careless turn.
  - o 11% were attributed to a distracted driver.
  - o 32% have unknown contributing driver actions (which is a separate category from no contributing driver actions).

Bicycle Crashes

This analysis identified the following trends for reported bicycle crashes on Washington Avenue between 2016 and 2020:

- 29% of bicycle crashes were attributed to driver actions:
  - o 15% were attributed to a driver performing a careless turn.
  - o 7% were attributed to aggressive driving (either red-light-running or tailgating).
  - o 3% were attributed to careless parking/un-parking.
  - o 3% were attributed to some other improper driver action.

- 37% of bicycle crashes were attributed to bicyclist actions:
  - o 18% were attributed to a person on a bicycle running a red light.
  - o 11% were attributed to some other improper action by the person on the bicycle.
  - o 3% were attributed to careless passing by a person on a bicycle.
  - o 3% were attributed to a person on a bicycle riding on the wrong side of the road.

- 11% of bicycle crashes were attributed to roadway conditions
  - o 7% were attributed to sudden weather and/or a wet roadway surface.
  - o 3% were attributed to the bicycle and/or motor vehicle changing lanes to avoid an object in the roadway.

Vehicle-only Crashes

This analysis identified the following trends for reported vehicle-only crashes on Washington Avenue between 2016 and 2020:

- 68% of vehicle-only crashes occurred at intersections. Table 2, below, breaks these crashes down by collision type:

T2. Intersection Crashes by Collision Type

Collision Type	% Total
Angle crash	66%
Rear-end crash	21%
Sideswipe (same direction)	6%
Head-on crash	4.5%
Sideswipe (opposite direction)	1.5%

- o Most intersection crashes (66%) were angle crashes. *(Note: two [2] angle crashes involved vehicles fleeing police. These crashes are excluded from the following analysis due to their unusual and irregular nature.)*
  - 64% of angle crashes at intersections involved vehicles traveling straight rather than turning.
  - The most common contributing factor to these crashes was red light running.
  - 87.5% of crashes attributed to red light running were caused by vehicles traveling on Washington Avenue. This indicates that red light running is a more serious issue on Washington Avenue than it is on streets that cross Washington Avenue.

- o **The second most-common type of angle crash at intersections involved vehicles turning left from Washington Avenue to a cross street.** These crashes account for 18% of all angle crashes at intersections. Most are attributed to improper/careless turning.

- o Additional contributing factors to angle crashes at intersections include:
  - careless passing or lane changing,
  - sudden slowing or stopping,
  - driving the wrong way,
  - turning from the wrong lane,
  - distracted driving,
  - inexperienced drivers,
  - failure to respond to traffic control devices (a separate category from red light running), and
  - making an illegal U-Turn.

- 32% of vehicle-only crashes occurred midblock. The table below breaks these crashes out by collision type:

T3. Mid-block Crashes by Collision Type

Collision Type	% Total
Angle crash	42%
Rear-end crash	32%
Sideswipe (same direction)	19%
Sideswipe (opposite direction)	19%

Because mid-block angle crashes are generally atypical, additional analysis was performed on only these crashes. Mid-block angle crashes on Washington Avenue generally fell into one (1) of two (2) categories:

1. vehicles making illegal U-turns (38% of mid-block angle crashes)
2. vehicles turning left or right out of driveways (38% of mid-block angle crashes)

Additional detail regarding these mid-block crashes is included in Section 3 as part of the discussion around potential crash remediation and safety improvement tools for Washington Avenue.

The remaining 23% of mid-block angle crashes is split evenly between crashes involving a vehicle leaving a parked position without clearance, crashes involving a vehicle using the center turn lane to execute a careless pass, and crashes involving a vehicle making an improper/careless left turn from Washington Avenue to a driveway.

Conclusion

This document summarized additional crash analysis completed by the Office of Complete Streets for Washington Avenue for years 2016 through 2020. The updated analysis presented in this document identified that people walking and people riding bicycles are overrepresented in crashes on Washington Avenue compared to Philadelphia County.

Based on this crash data analysis and a review of literature cited, several countermeasures discussed could reduce the risk factors for crashes on Washington Avenue. These include vehicle lane reductions; protected bicycle lanes; automated red light cameras; addressing turning movements onto Washington Avenue from minor approaches; and slowing motor vehicle turns.

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Appendices

A1. Type of Crash by Year

A1.1 Pedestrian Crashes by Year

All Years	44	26% of all crashes
2016	07	16% of pedestrian crashes
2017	08	18% of pedestrian crashes
2018	10	23% of pedestrian crashes
2019	07	16% of pedestrian crashes
2020	12	27% of pedestrian crashes

A1.2 Bicycle Crashes by Year

All Years	27	16% of all crashes
2016	10	37% of bicycle crashes
2017	10	37% of bicycle crashes
2018	03	11% of bicycle crashes
2019	02	07% of bicycle crashes
2020	02	07% of bicycle crashes

A1.3 Vehicle-only Crashes by Year

All Years	98	58% of all crashes
2016	30	31% of vehicle-only crashes
2017	19	19% of vehicle-only crashes
2018	19	19% of vehicle-only crashes
2019	13	13% of vehicle-only crashes
2020	17	17% of vehicle-only crashes

A2. Injury Severity by Type of Crash

A2.1 Injury Severity for Pedestrian Crashes

Pedestrian Crashes	44	26% of all crashes
Crashes with at least one injury or fatality	44	100% of pedestrian crashes resulted in an injury or fatality
Crashes with zero injuries or fatalities	0	00% of pedestrian crashes did not result in an injury or fatality
Fatal crashes	2	05% of pedestrian crashes resulted in a fatality
Suspected Serious Injury crashes	3	07% of pedestrian crashes resulted in a suspected serious injury
Suspected Minor Injury crashes	17	39% of pedestrian crashes resulted in a suspected minor injury
Possible Injury crashes	12	27% of pedestrian crashes resulted in a possible injury
Unknown Injury Severity crashes	12	27% of pedestrian crashes resulted in an injury of unknown severity
Unknown if injured crashes	3	7% of pedestrian crashes involved in a person whose injury status is unknown

A2.2 Injury Severity for Bicycle Crashes

Bicycle Crashes	27	16% of all crashes
Crashes with at least one injury or fatality	27	100% of bicycle crashes resulted in an injury or fatality
Crashes with zero injuries or fatalities	0	00% of bicycle crashes did not result in an injury or fatality
Fatal crashes	0	00% of bicycle crashes resulted in a fatality
Suspected Serious Injury crashes	1	04% of bicycle crashes resulted in a suspected serious injury
Suspected Minor Injury crashes	6	22% of bicycle crashes resulted in a suspected minor injury
Possible Injury crashes	12	44% of bicycle crashes resulted in a possible injury
Unknown Injury Severity crashes	8	30% of bicycle crashes resulted in an injury of unknown severity

Unknown if injured crashes	4	15% of bicycle crashes involved in a person whose injury status is unknown

A2.3 Injury Severity for Vehicle-only Crashes

Vehicle-only Crashes	98	58% of all crashes
Crashes with at least one injury or fatality	73	74% of vehicle-only crashes resulted in an injury or fatality
Crashes with zero injuries or fatalities	25	25% of vehicle-only crashes did not result in an injury or fatality
Fatal crashes	1	01% of vehicle-only crashes resulted in a fatality
Suspected Serious Injury crashes	1	01% of vehicle-only crashes resulted in a suspected serious injury
Suspected Minor Injury crashes	17	17% of vehicle-only crashes resulted in a suspected minor injury
Possible Injury crashes	36	37% of vehicle-only crashes resulted in a possible injury
Unknown Injury Severity crashes	24	25% of vehicle-only crashes resulted in an injury of unknown severity
Unknown if injured crashes	7	07% of bicycle crashes involved in a person whose injury status is unknown