URGENT ITEM
AGENDA MATERIAL

Government Code Section 54954.2(b)
Rules of Procedure Chapter III.C.5

THIS ITEM IS NOT YET AGENDIZED AND MAY OR MAY NOT BE ACCEPTED FOR THE AGENDA AS A LATE ITEM, SUBJECT TO THE CITY COUNCIL'S DISCRETION ACCORDING TO BROWN ACT RULES

Meeting Date: **April 11, 2023**

Item Description: **Letter in Support AB 645 and requesting that the City of Berkeley be added to subject jurisdictions**

This item is submitted pursuant to the provision checked below:

☐ Emergency Situation (54954.2(b)(1) - majority vote required)
Determination by a majority vote of the legislative body that an emergency situation exists, as defined in Section 54956.5.

■ Immediate Action Required (54954.2(b)(2) - two-thirds vote required)
There is a need to take immediate action and the need for action came to the attention of the local agency subsequent to the agenda for this meeting being posted.

Once the item is added to the agenda (Consent or Action) it must be passed by the standard required vote threshold (majority, two-thirds, or 7/9).

Facts supporting the addition of the item to the agenda under Section 54954.2(b) and Chapter III.C.5 of the Rules of Procedure:

The need for action came to the attention of the Council subsequent to the agenda for this meeting being posted. Although Councilmembers were previously aware of AB 645, they were not aware that the legislation, as currently written, would not include Berkeley in pilot speed enforcement programs. There is a need to take immediate action because this legislation will potentially be going through the California State Assembly committee process prior to the next scheduled City Council meeting, and ensuring that the City of Berkeley is included in the legislation will likely be easiest to achieve if it takes place earlier in the legislative process.

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CONSENT CALENDAR
April 11, 2023

To: Members of the Berkeley City Council

From: Councilmember Mark Humbert (Author)
Mayor Jesse Arreguín (Co-sponsor)
Councilmember Terry Taplin (Co-sponsor)
Councilmember Rashi Kesarwani (Co-sponsor)

Subject: [URGENCY ITEM] Sending a letter to Assemblymembers Friedman and Wicks to request Berkeley's Inclusion in AB 645 (Speed Safety System Pilot Programs)

RECOMMENDATION

Send a letter to Assemblymembers Friedman and Wicks in support of AB 645 (Friedman) and requesting that Berkeley be added to the list of cities the bill would authorize to establish a Speed Safety System Pilot Program.

SUMMARY

Automated enforcement of vehicular speed limits is a proven means of increasing compliance with posted speed limits and also helps reduce the role of potential police bias in speed limit enforcement. These outcomes serve to improve roadway safety, reduce police interactions and enforcement disparities, and free up police time to address other even higher-risk crimes. The Berkeley City Council has previously expressed interest in exploring options for automated enforcement, but lacked the necessary authorization under State law for the Berkeley Police Department (BPD) to pursue this option. AB 645 would authorize subject cities to establish a Speed Safety System Pilot Program that would allow for automated enforcement, but the legislation does not currently list Berkeley as a subject City. This item would send a letter requesting that Berkeley be added as a subject City.

FINANCIAL IMPLICATIONS

Staff time to prepare and send a letter.

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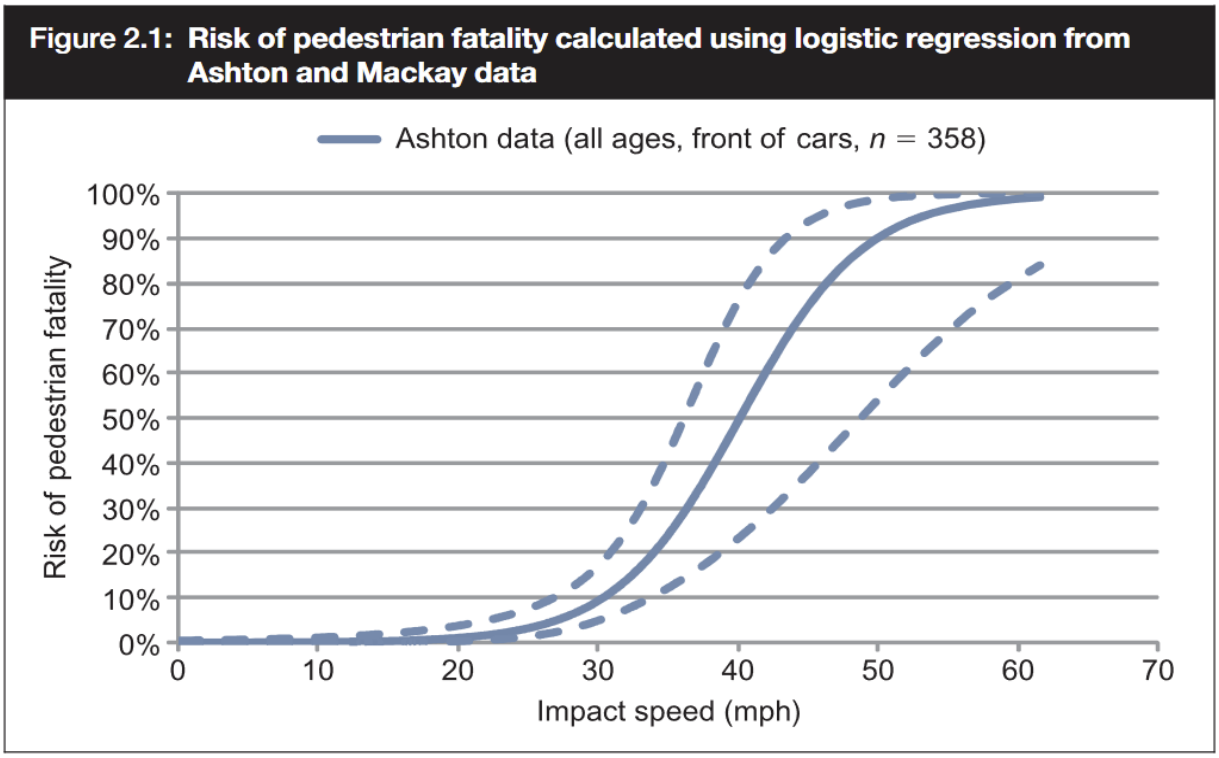
RATIONALE FOR RECOMMENDATION

The City of Berkeley suffers from an unacceptable levels of traffic violence. From 2019 to 2022 the City had 1,815 injury collisions and 15 traffic fatalities (per BPD). These numbers far exceed Berkeley's Vision Zero goals, which aim for a future with no traffic injuries or deaths. People walking and biking are especially vulnerable. The inadequacy of existing safety measures contributes to this elevated risk and discourages people from walking and biking in Berkeley. This harms Berkeley's ability to meet public health and climate action goals related to increasing non-automotive mobility.

Higher vehicle speeds detract from drivers' ability to respond in time to prevent collisions and increase the severity of injuries and the risk of death, especially for people on foot and riding bikes. The following figure, from a 2010 report titled Relationship between Speed and Risk of Fatal Injury: Pedestrians and Car Occupants for the Department for Transport: London, shows that the risk of pedestrian fatality rises dramatically from roughly 5 percent for vehicle speeds of 25 miles per hour (mph) to roughly 30 percent for vehicle speeds of 35 mph. Ensuring that vehicles maintain lower speeds is therefore crucial to pedestrian and cyclist safety.

Figure 2.1: Risk of pedestrian fatality calculated using logistic regression from Ashton and Mackay data



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According to BPD statistics, unsafe speed was the top collision factor in 2021 and the second-highest collision factor in 2022. This strongly indicates that reducing vehicle speeds has a high likelihood of reducing traffic collisions and resulting injuries/deaths. Moreover, since BPD statistics indicate that drivers are at fault in approximately 50 percent of cyclist-involved collisions and 80 to 90 percent of pedestrian-involved collisions, addressing unsafe driving behavior could significantly reduce risks to cyclists and pedestrians.

ENVIRONMENTAL SUSTAINABILITY AND CLIMATE IMPACTS

Reducing driving speeds would have an uncertain but likely negligible impact on greenhouse gas emissions from driving. According to the US Department of Energy, most cars operate at their highest efficiency between 40 and 50 mph; however, decreasing acceleration and braking also serve to improve fuel efficiency. Ensuring greater compliance with speed limits would serve to reduce average vehicle speeds even further below peak efficiency, but would also reduce the likelihood of aggressive acceleration and braking. Whether these factors would fully counterbalance one another could depend on the make and model of the car, driver habits etc.

Greater environmental sustainability and climate impacts are likely to be realized through the indirect impacts improved pedestrian and cyclist safety would have on mode share in Berkeley. Automated speed limit enforcement would improve roadway safety for all users. And people are more likely to walk, bike, and take transit as a means of mobility if they feel safe doing so. Therefore the Speed Safety System Pilot Program enabled by AB 645 would have a high likelihood of helping Berkeley reduce its reliance on cars and therefore its greenhouse gas emissions from transportation.

POSSIBLE FUTURE ACTION

If AB 645 is amended to include Berkeley, passed by the California legislature, and signed by Governor Newsom, Berkeley would be authorized—but not necessarily required—to implement a Speed Safety System Pilot Program. The City Council would then be able to move forward with the formulation, funding, and implementation of a local program to operationalize automated speed limit enforcement.

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FISCAL IMPACTS OF POSSIBLE FUTURE ACTION

If the City Council and staff/BPD were to move forward with a Pilot Program, future fiscal impacts could include the costs of obtaining, installing, maintaining relevant equipment, as well as ongoing staff time for monitoring and processing the policies and data associated with the pilot. Any Speed Safety System Pilot Program could potentially result in a brief increase in revenues from speeding tickets during a transition period where drivers are adapting to a greater likelihood of regular speed limit enforcement.

CONTACT PERSON

Councilmember Mark Humbert District 8 510-981-7180

Attachments

1. Draft Letter to Assemblymembers Friedman and Wicks
2. AB 645 Bill Legislative Digest and Text (As of February 9, 2023)
3. Berkeley Police Department Annual Report 2022 Year End Data Reports, *from March 14, 2023 City Council Worksession*
4. Berkeley Police Department Annual Report 2022 Powerpoint Presentation, *from March 14, 2023 City Council Worksession*
5. Road Safety Web Publication No. 16 Relationship between Speed and Risk of Fatal Injury: Pedestrians and Car Occupants, D. C. Richards Transport Research Laboratory, September 2010, Department for Transport: London
6. Gas Mileage Tips - Driving More Efficiently; US Department of Energy https://www.fueleconomy.gov/feg/driveHabits.jsp

Attachment 1

The Honorable Laura Friedman
Member of the California State Assembly
California State Capitol
Sacramento, CA 95814

The Honorable Buffy Wicks
Member of the California State Assembly
California State Capitol
Sacramento, CA 95814

Re: Support for AB 645: *Vehicles: speed safety system pilot program* and requesting Berkeley's inclusion in the list of subject jurisdictions

Dear Assemblymembers Friedman and Wicks,

The City of Berkeley writes to express its strong support for AB 645 and expanding automated traffic enforcement, and to respectfully request that AB 645 be amended to include the City of Berkeley in the list of jurisdictions permitted to pursue speed safety system pilot programs.

The Berkeley City Council feels strongly that Berkeley would make an excellent addition to the list of pilot program cities. Berkeley is densely populated with high levels of pedestrian and bicycle mode share and relatively low speed limits on most streets. Unfortunately, Berkeley also still suffers from elevated levels of traffic injuries and deaths and a significant proportion of these are due to unsafe speeds. A speed safety system pilot program would therefore likely offer strong benefits for pedestrian/bicyclist safety and be highly cost-effective in Berkeley.

Thank you for your leadership on this important legislation.

Sincerely,
Berkeley City Council
2180 Milvia St
Berkeley, CA 94709

AMENDED IN ASSEMBLY MARCH 30, 2023
AMENDED IN ASSEMBLY MARCH 16, 2023

CALIFORNIA LEGISLATURE— 2023–2024 REGULAR SESSION

ASSEMBLY BILL **NO. 645**

Introduced by Assembly ~~Member~~ *Members* Friedman *and Ting*
(Principal coauthor: Senator Wiener)
(Coauthors: Assembly Members Berman, Haney, Lee, and Wicks)

February 09, 2023

An act to amend, repeal, and add Section 70615 of the Government Code, and to add and repeal Article 3 (commencing with Section 22425) of Chapter 7 of Division 11 of the Vehicle Code, relating to vehicles.

LEGISLATIVE COUNSEL'S DIGEST

AB 645, as amended, Friedman. Vehicles: speed safety system pilot program.

Existing law establishes a basic speed law that prohibits a person from driving a vehicle upon a highway at a speed greater than is reasonable or prudent given the weather, visibility, traffic, and highway conditions and in no event at a speed that endangers the safety of persons or property.

This bill would authorize, until January 1, 2032, the Cities of Los Angeles, San Jose, Oakland, Glendale, and Long Beach, and the City and County of San Francisco to establish a Speed Safety System Pilot Program if the system meets specified requirements. The bill would require a participating city or city and county to adopt a Speed Safety System Use Policy and a Speed Safety System Impact Report before implementing the program, and would require the participating city or city and county to engage in a public information campaign at least 30 days before implementation of the program, including information relating to when the systems would begin detecting violations and where the systems would be utilized. The bill would require a participating city or city and county to issue warning notices rather than notices of violations for violations detected within the first 60 calendar days of the program. The bill would also require a participating city or city and county to develop uniform guidelines for, among other things, the processing and storage of confidential information. The bill would designate all photographic, video, or other visual or administrative records, not including data about the number of violations issued or the speeds at which they were issued for, made by a system as confidential, and would only authorize public agencies to use and allow access to these records for specified purposes.

This bill would specify that any violation of a speed law recorded by a speed safety system authorized by these provisions would be subject only to the provided civil penalties. The bill would, among other things, provide for the issuance of a notice of violation, an initial review, an administrative hearing, and an appeals process, as specified, for a violation under this program. The bill would require any program created pursuant to these provisions to offer a diversion program for indigent speed safety system violation recipients, as

specified. The bill would require a city or city and county participating in the pilot program to submit a report to evaluate the speed safety system to determine the system's impact on street safety and economic impact on the communities where the system is utilized.

Existing law establishes a $25 filing fee for specified appeals and petitions.

This bill would require a $25 filing fee for an appeal challenging a notice of violation issued as a result of a speed safety system until January 1, 2032.

Existing constitutional provisions require that a statute that limits the right of access to the meetings of public bodies or the writings of public officials and agencies be adopted with findings demonstrating the interest protected by the limitation and the need for protecting that interest.

This bill would make legislative findings to that effect.

This bill would make legislative findings and declarations as to the necessity of a special statute for the Cities of Los Angeles, San Jose, Oakland, Glendale, and Long Beach, and the City and County of San Francisco.

Digest Key

Vote: majority Appropriation: no Fiscal Committee: yes Local Program: no

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Bill Text

THE PEOPLE OF THE STATE OF CALIFORNIA DO ENACT AS FOLLOWS:

SECTION 1. The Legislature finds and declares all of the following:

(a) Speed is a major factor in traffic collisions that result in fatalities or injuries.

(b) State and local agencies employ a variety of methods to reduce speeding, including traffic engineering, education, and enforcement.

(c) Traffic speed enforcement is critical to efforts in California to reduce factors that contribute to traffic collisions that result in fatalities or injuries.

(d) However, traditional enforcement methods have had a well-documented disparate impact on communities of color, and implicit or explicit racial bias in police traffic stops puts drivers of color at risk.

(e) Additional tools, including speed safety systems, are available to assist cities and the state in addressing excessive speeding and speed-related crashes.

(f) Speed safety systems offer a high rate of detection, and, in conjunction with education and traffic engineering, can significantly reduce speeding, improve traffic safety, and prevent traffic-related fatalities and injuries, including roadway worker fatalities.

(g) Multiple speed safety system programs implemented in other states and cities outside of California have proven successful in reducing speeding and addressing traffic safety concerns.

(h) The Transportation Agency's "CalSTA Report of Findings: AB 2363 Zero Traffic Fatalities Task Force," issued in January 2020, concluded that international and domestic studies show that speed safety systems are an effective countermeasure to speeding that can deliver meaningful safety improvements, and identified several policy considerations that speed safety system program guidelines could consider.

(i) In a 2017 study, the National Transportation Safety Board (NTSB) analyzed studies of speed safety system programs, and found they offered significant safety improvements in the forms of reduction in mean speeds, reduction in the likelihood of speeding more than 10 miles per hour over the posted speed limit, and reduction in the likelihood that a crash involved a severe injury or fatality. The same study recommended that all states remove obstacles to speed safety system programs to increase the use of this proven approach, and notes that programs should be explicitly authorized by state legislation without operational and location restrictions.

(j) The National Highway Traffic Safety Administration (NHTSA) gives speed safety systems the maximum 5-star effectiveness rating. NHTSA issued speed enforcement camera systems operational guidelines in 2008, and is expected to release revised guidelines in 2021 that should further inform the development of state guidelines.

(k) Speed safety systems can advance equity by improving reliability and fairness in traffic enforcement while making speeding enforcement more predictable, effective, and broadly implemented, all of which helps change driver behavior.

(l) Enforcing speed limits using speed safety systems on streets where speeding drivers create dangerous roadway environments is a reliable and cost-effective means to prevent further fatalities and injuries.

SEC. 2. Section 70615 of the Government Code is amended to read:

70615. The fee for filing any of the following appeals to the superior court is twenty-five dollars ($25):

(a) An appeal of a local agency's decision regarding an administrative fine or penalty under Section 53069.4.

(b) An appeal under Section 40230 of the Vehicle Code of an administrative agency's decision regarding a parking violation.

(c) An appeal under Section 99582 of the Public Utilities Code of a hearing officer's determination regarding an administrative penalty for fare evasion or a passenger conduct violation.

(d) A petition under Section 186.35 of the Penal Code challenging a law enforcement agency's inclusion of a person's information in a shared gang database.

(e) An appeal under Section 22428 of the Vehicle Code of a hearing officer's determination regarding a civil penalty for an automated speed violation, as defined in Section 22425 of the Vehicle Code.

(f) This section shall remain in effect only until January 1, 2032, and as of that date is repealed.

SEC. 3. Section 70615 is added to the Government Code, to read:

70615. The fee for filing any of the following appeals to the superior court is twenty-five dollars ($25):

(a) An appeal of a local agency's decision regarding an administrative fine or penalty under Section 53069.4.

(b) An appeal under Section 40230 of the Vehicle Code of an administrative agency's decision regarding a parking violation.

(c) An appeal under Section 99582 of the Public Utilities Code of a hearing officer's determination regarding an administrative penalty for fare evasion or a passenger conduct violation.

(d) A petition under Section 186.35 of the Penal Code challenging a law enforcement agency's inclusion of a person's information in a shared gang database.

(e) This section shall become operative on January 1, 2032.

SEC. 4. Article 3 (commencing with Section 22425) is added to Chapter 7 of Division 11 of the Vehicle Code, to read:

Article 3. Speed Safety System Pilot Program

22425. (a) As used in this article, the following definitions apply:

(1) "Automated speed violation" means a violation of a speed law detected by a speed safety system operated pursuant to this article.

(2) "Designated jurisdiction" means any of the Cities of Los Angeles, San Jose, Oakland, Glendale, or Long Beach, or the City and County of San Francisco.

(3) "Indigent" has the same meaning as defined in subdivision (c) of Section 40220.

(4) "Local department of transportation" means a designated jurisdiction's department of transportation or, if a designated jurisdiction does not have a department of transportation, their administrative division, including, but not limited to, a public works department that administers transportation and traffic matters under this code.

(5) "Speed safety system" or "system" means a fixed or mobile radar or laser system or any other electronic device that utilizes automated equipment to detect a violation of speeding laws and is designed to obtain a clear photograph, video recording, or other visual image of a vehicle license plate.

(b) (1) A designated jurisdiction may establish a program utilizing a speed safety system for speed enforcement, to be operated by a local department of transportation, in the following areas:

(A) On a street meeting the standards of a safety corridor under Section 22358.7.

(B) On a street a local authority has determined to have had a high number of incidents for motor vehicle speed contests or motor vehicle exhibitions of speed.

(C) School zones, subject to subdivision (c).

(2) The number of speed safety systems operated by a designated jurisdiction at any time shall be limited as follows:

(A) For a jurisdiction with a population over 3,000,000, no more than ___ systems.

(B) For a jurisdiction with a population between 800,000 and 3,000,000, inclusive, no more than ___ systems.

(C) For a jurisdiction with a population of 300,000 up to 800,000, no more than ___ systems.

(D) For a jurisdiction with a population of less than 300,000, no more than ___ systems.

(c) If a school zone has a posted speed limit of 30 miles per hour or higher when children are not present, a designated jurisdiction may only enforce the school zone speed limit up to two hours before the regular school session begins and up to two hours after regular school session concludes. For these school zones, flashing beacons activated by a time clock, other automatic device, or manual activation shall be installed on the school zone speed limit sign and active to indicate the times during which the school zone speed limit is enforced with a speed safety system.

(d) A speed safety system for speed limit enforcement may be utilized pursuant to subdivision (b) if the program meets all of the following requirements:

(1) Clearly identifies the presence of the speed safety system by signs stating "Photo Enforced," along with the posted speed limit within 500 feet of the system. The signs shall be visible to traffic traveling on the street from the direction of travel for which the system is utilized, and shall be posted at all locations as may be determined necessary by the Department of Transportation through collaboration with the California Traffic Control Devices Committee.

(2) Identifies the streets or portions of streets that have been approved for enforcement using a speed safety system and the hours of enforcement on the municipality's internet website, which shall be updated whenever the municipality changes locations of enforcement.

(3) Ensures that the speed safety system is regularly inspected and certifies that the system is installed and operating properly. Each camera unit shall be calibrated in accordance with the manufacturer's instructions, and at least once per year by an independent calibration laboratory. Documentation of the regular inspection, operation, and calibration of the system shall be retained until the date on which the system has been permanently removed from use.

(4) Utilizes fixed or mobile speed safety systems that provide real-time notification when violations are detected.

(e) A speed safety system shall not be operated on any California state route, including all freeways and expressways, United States Highway, Interstate Highway, or any public road in an unincorporated county where the Commissioner of the California Highway Patrol has full responsibility and primary jurisdiction for the administration and enforcement of the laws, and for the investigation of traffic accidents, pursuant to Section 2400.

(f) Prior to enforcing speed laws utilizing speed safety systems, the designated jurisdiction shall do both of the following:

(1) Administer a public information campaign for at least 30 calendar days prior to the commencement of the program, which shall include public announcements in major media outlets and press releases. The public information campaign shall include the draft Speed Safety System Use Policy pursuant to subdivision (g), the Speed Safety System Impact Report pursuant to subdivision (h), information on when systems will begin detecting violations, the streets, or portions of streets, where systems will be utilized, and the designated jurisdiction's internet website, where additional information about the program can be obtained. Notwithstanding the above, no further public announcement by the municipality shall be required for additional systems that may be added to the program.

(2) Issue warning notices rather than notices of violation for violations detected by the speed safety systems during the first 60 calendar days of enforcement under the program. If additional systems are utilized on additional streets after the initial program implementation, the designated jurisdiction shall issue warning notices rather than notices of violation for violations detected by the new speed safety systems during the first 60 calendar days of enforcement for the additional streets added to the program.

(g) The local governing body of a designated jurisdiction shall adopt a Speed Safety System Use Policy before entering into an agreement regarding a speed safety system, purchasing or leasing equipment for a program, or implementing a program. The Speed Safety System Use Policy shall include the specific purpose for the system, the uses that are authorized, the rules and processes required prior to that use, and the uses that are prohibited. The policy shall include the data or information that can be collected by the speed safety system and the individuals who can access or use the collected information, and the rules and processes related to the access or use of the information. The policy shall also include provisions for protecting data from unauthorized access, data retention, public access, third-party data sharing, training, auditing, and oversight to ensure compliance with the Speed Safety System Use Policy. The Speed Safety System Use Policy shall be made available for public review, including, but not limited to, by posting it on the local governing body's internet website at least 30 calendar days prior to adoption by the local governing body.

(h) (1) The local governing body also shall approve a Speed Safety System Impact Report prior to implementing a program. The Speed Safety System Impact Report shall include all of the following information:

(A) Assessment of potential impact of the speed safety system on civil liberties and civil rights and any plans to safeguard those public rights.

(B) Description of the speed safety system and how it works.

(C) Fiscal costs for the speed safety system, including program establishment costs, ongoing costs, and program funding.

(D) If potential deployment locations of systems are predominantly in low-income neighborhoods, a determination of why these locations experience high fatality and injury collisions due to unsafe speed.

(E) Locations where the system may be deployed and traffic data for these locations.

(F) Proposed purpose of the speed safety system.

(2) The Speed Safety System Impact Report shall be made available for public review at least 30 calendar days prior to adoption by the governing body.

(3) The local governing body shall consult and work collaboratively with relevant local stakeholder organizations, including racial equity, privacy protection, and economic justice groups, in developing the Speed Safety System Use Policy and Speed Safety System Impact Report.

(i) The designated jurisdiction shall develop uniform guidelines for both of the following:

(1) The screening and issuing of notices of violation.

(2) The processing and storage of confidential information and procedures to ensure compliance with confidentiality requirements.

(j) Notices of violation issued pursuant to this section shall include a clear photograph, video recording, or other visual image of the license plate and rear of the vehicle only, the Vehicle Code violation, the camera location, and the date and time when the violation occurred. Notices of violation shall exclude images of the rear window area of the vehicle.

(k) The photographic, video, or other visual evidence stored by a speed safety system does not constitute an out-of-court hearsay statement by a declarant under Division 10 (commencing with Section 1200) of the Evidence Code.

(l) (1) Notwithstanding Sections 6253 and 6262 of the Government Code, or any other law, photographic, video, or other visual or administrative records made by a system shall be confidential. Public agencies shall use and allow access to these records only for the purposes authorized by this article or to assess the impacts of the system. Data about the number of violations issued and the speeds at which they were issued for is not considered administrative records required to be confidential by this section.

(2) Confidential information obtained from the Department of Motor Vehicles for the administration of speed safety systems and enforcement of this article shall be held confidential, and shall not be used for any other purpose.

(3) Except for court records described in Section 68152 of the Government Code, or as provided in paragraph (4), the confidential records and evidence described in paragraphs (1) and (2) may be retained for up to 60 days after final disposition of the notice of violation, except the designated jurisdiction may retain information on vehicles that have been cited and convicted of a violation for up to three years. The municipality may adopt a retention period of less than 60 days in the Speed Safety System Use Policy. Administrative records described in paragraph (1) may be retained for up to 120 days after final disposition of the notice of violation. Notwithstanding any other law, the confidential records and evidence shall be destroyed in a manner that maintains the confidentiality of any person included in the record or evidence.

(4) Notwithstanding Section 26202.6 of the Government Code, photographic, video, or other visual evidence that is obtained from a speed safety system that does not contain evidence of a speeding violation shall be destroyed within five business days after the evidence was first obtained. The use of facial recognition technology in conjunction with a speed safety system shall be prohibited.

(5) Information collected and maintained by a designated jurisdiction using a speed safety system shall only be used to administer a program, and shall not be disclosed to any other persons, including, but not limited to, any other state or federal government agency or official for any other purpose, except as required by state or federal law, court order, or in response to a subpoena in an individual case or proceeding.

(m) Notwithstanding subdivision (l), the registered owner or an individual identified by the registered owner as the driver of the vehicle at the time of the alleged violation shall be permitted to review the photographic, video, or visual evidence of the alleged violation.

(n) A contract between the designated jurisdiction and a manufacturer or supplier of speed safety systems shall allow the local authority to purchase materials, lease equipment, and contract for processing services from the manufacturer or supplier based on the services rendered on a monthly schedule or another schedule agreed upon by the municipality and contractor. The contract shall not include provisions for payment or compensation based on the number of notices of violation issued by a designated municipal employee, or as a percentage of revenue generated, from the use of the system. The contract shall include a provision that all data collected from the speed safety systems is confidential, and shall prohibit the manufacturer or supplier of speed safety systems from sharing, repurposing, or monetizing collected data, except as specifically authorized in this article. The designated jurisdiction shall oversee and maintain control over all enforcement activities, including the determination of when a notice of violation should be issued.

(o) Notwithstanding subdivision (n), a designated jurisdiction may contract with a vendor for the processing of notices of violation after a designated employee of the jurisdiction has issued a notice of violation. The vendor shall be a separate legal and corporate entity from, and unrelated or affiliated in any manner with, the manufacturer or supplier of speed safety systems used by the designated jurisdiction. Any contract between the designated jurisdiction and a vendor to provide processing services may include a provision for the payment of compensation based on the number of notices of violation processed by the vendor.

~~(p)(1)A speed safety system shall not be operated on any given street if ____ has not been met.~~

(p) (1) A speed safety system at a specific location shall be operated only if, within the first 18 months of installation of a system, one of the following thresholds has been met:

(A) A reduction in the 85th percentile speed of vehicles compared to data collected before the system was in operation.

(B) A 20-percent reduction in vehicles that exceed the posted speed limit by 10 miles per hour or more compared to data collected before the system was in operation.

(C) A 20-percent reduction in the number of violators who received two or more violations at the location since the system became operational.

(2) (A) This subdivision does not apply if a designated jurisdiction adds traffic-calming measures to the street. "Traffic-calming measures" include, but are not limited to, all of the following:

(i) Bicycle lanes.

(ii) Chicanes.

(iii) Chokers.

(iv) Curb extensions.

(v) Median islands.

(vi) Raised crosswalks.

(vii) Road diets.

(viii) Roundabouts.

(ix) Speed humps or speed tables.

(x) Traffic circles.

(B) A designated jurisdiction may continue to operate a speed safety system with a fixed or mobile vehicle speed feedback sign while traffic-calming measures are being planned or constructed.

22426. (a) Notwithstanding any other law, a violation of Section 22350, or any other speed law pursuant to this chapter that is recorded by a speed safety system authorized pursuant to Section 22425 shall be subject only to a civil penalty, as provided in subdivision (c), and shall not result in the department suspending or revoking the privilege of a violator to drive a motor vehicle or in a violation point being assessed against the violator.

(b) The speed safety system shall capture images of the rear license plate of vehicles that are traveling 11 miles per hour or more over the posted speed limit and notices of violation shall only be issued to vehicles based on that evidence.

(c) A civil penalty shall be assessed as follows:

(1) Fifty dollars ($50) for a speed violation from 11 up to 15 miles per hour over the posted speed limit.

(2) One hundred dollars ($100) for a speed violation from 16 up to 25 miles per hour over the posted speed

limit.

(3) Two hundred dollars ($200) for a speed violation of 26 miles per hour or more over the posted speed limit, unless paragraph (4) applies.

(4) Five hundred dollars ($500) for traveling at a speed of 100 miles per hour or greater.

(d) A civil penalty shall not be assessed against an authorized emergency vehicle.

(e) The written notice of violation shall be issued to the registered owner of the vehicle within 15 calendar days of the date of the violation. The notice of violation shall include all of the following information:

(1) The violation, including reference to the speed law that was violated.

(2) The date, approximate time, and location where the violation occurred.

(3) The vehicle license number and the name and address of the registered owner of the vehicle.

(4) A statement that payment is required to be made no later than 30 calendar days from the date of mailing of the notice of violation, or that the violation may be contested pursuant to Section 22427.

(5) The amount of the civil penalty due for that violation and the procedures for the registered owner, lessee, or rentee to pay the civil penalty or to contest the notice of violation.

(6) An affidavit of nonliability, and information of what constitutes nonliability, information as to the effect of executing the affidavit, and instructions for returning the affidavit to the processing agency. If the affidavit of nonliability is returned to the processing agency within 30 calendar days of the mailing of the notice of violation, together with proof of a written lease or rental agreement between a bona fide rental or leasing company and its customer that identifies the rentee or lessee, the processing agency shall serve or mail a notice of violation to the rentee or lessee identified in the affidavit of nonliability.

(f) Mobile radar or laser systems shall not be used until at least two years after the installation of the first fixed radar or laser system unless the mobile radar or laser system is kept at a fixed location.

(g) (1) Revenues derived from any program utilizing a speed safety system for speed limit enforcement shall first be used to recover program costs. Program costs include, but are not limited to, the construction of traffic-calming measures for the purposes of complying with subdivision (p) of Section 22425, the installation of speed safety systems, the adjudication of violations, and reporting requirements as specified in this section.

(2) Jurisdictions shall maintain their existing commitment of local funds for traffic-calming measures in order to remain authorized to participate in the pilot program, and shall annually expend not less than the annual average of expenditures for traffic-calming measures during the 2016–17, 2017–18, and 2018–19 fiscal years. For purposes of this subdivision, in calculating average expenditures on traffic-calming measures, restricted funds that may not be available on an ongoing basis, including those from voter-approved bond issuances or tax measures, shall not be included. Any excess revenue shall be used for traffic-calming measures within three years. If traffic-calming measures are not planned or constructed after the third year, excess revenue shall revert to the Active Transportation Program established pursuant to Chapter 8 (commencing with Section 2380) of the Streets and Highways Code, to be allocated by the California Transportation Commission pursuant to Section 2381 of the Streets and Highways Code.

(h) A speed safety system may only be in operation for five years, or until January 1, 2032, whichever date is sooner.

22427. (a) For a period of 30 calendar days from the mailing of a notice of violation, a person may request an initial review of the notice by the issuing agency. The request may be made by telephone, in writing, electronically, or in person. There shall be no charge for this review. If, following the initial review, the issuing agency is satisfied that the violation did not occur, or that extenuating circumstances make dismissal of the notice of violation appropriate in the interest of justice, the issuing agency shall cancel the notice of violation. The issuing agency shall advise the processing agency, if any, of the cancellation. The issuing agency or the processing agency shall mail the results of the initial review to the person contesting the notice, and, if cancellation of the notice does not occur following that review, include a reason for that denial, notification of the ability to request an administrative hearing, and notice of the procedure adopted pursuant to paragraph (2) of subdivision (b) for waiving prepayment of the civil penalty based upon an inability to pay.

(b) (1) If the person contesting the notice of violation is dissatisfied with the results of the initial review, the person may, no later than 21 calendar days following the mailing of the results of the issuing agency's initial review, request an administrative hearing of the violation. The request may be made by telephone, in writing, electronically, or in person.

(2) The person requesting an administrative hearing shall pay the amount of the civil penalty to the processing agency. The issuing agency shall adopt a written procedure to allow a person to request an administrative hearing without payment of the civil penalty upon satisfactory proof of an inability to pay the amount due.

(3) The administrative hearing shall be held within 90 calendar days following the receipt of a request for an administrative hearing. The person requesting the hearing may request one continuance, not to exceed 21 calendar days.

(c) The administrative hearing process shall include all of the following:

(1) The person requesting a hearing shall have the choice of a hearing by mail, video conference, or in person. An in-person hearing shall be conducted within the jurisdiction of the issuing agency.

(2) If the person requesting a hearing is a minor, that person shall be permitted to appear at a hearing or admit responsibility for the automated speed violation without the appointment of a guardian. The processing agency may proceed against the minor in the same manner as against an adult.

(3) The administrative hearing shall be conducted in accordance with written procedures established by the issuing agency and approved by the governing body or chief executive officer of the issuing agency. The hearing shall provide an independent, objective, fair, and impartial review of contested automated speed violations.

(4) (A) The issuing agency's governing body or chief executive officer shall appoint or contract with qualified independent examiners or administrative hearing providers that employ qualified independent examiners to conduct the administrative hearings. Examiners shall demonstrate the qualifications, training, and objectivity necessary to conduct a fair and impartial review. The examiner shall be separate and independent from the notice of violation collection or processing function. An examiner's continued employment, performance evaluation, compensation, and benefits shall not, directly or indirectly, be linked to the amount of civil penalties collected by the examiner or the number or percentage of violations upheld by the examiner.

(B) (i) Examiners shall have a minimum of 20 hours of training. The examiner is responsible for the costs of the training. The issuing agency may reimburse the examiner for those costs. Training may be provided through any of the following:

(I) An accredited college or university.

(II) A program conducted by the Commission on Peace Officer Standards and Training.

(III) A program conducted by the American Arbitration Association or a similar organization.

(IV) Any program approved by the governing body or chief executive officer of the issuing agency, including a program developed and provided by, or for, the agency.

(ii) Training programs may include topics relevant to the administrative hearing, including, but not limited to, applicable laws and regulations, enforcement procedures, due process, evaluation of evidence, hearing procedures, and effective oral and written communication. Upon the approval of the governing body or chief executive officer of the issuing agency, up to 12 hours of relevant experience may be substituted for up to 12 hours of training. Up to eight hours of the training requirements described in this subparagraph may be credited to an individual, at the discretion of the governing body or chief executive officer of the issuing agency, based upon training programs or courses described in this subparagraph that the individual attended within the last five years.

(5) The designated municipal employee who issues a notice of violation shall not be required to participate in an administrative hearing. The issuing agency shall not be required to produce any evidence other than, in proper form, the notice of violation or copy thereof, including the photograph, video, or other visual image of the vehicle's license plate, and information received from the Department of Motor Vehicles identifying the registered owner of the vehicle. The documentation in proper form shall be prima facie evidence of the violation.

(6) The examiner's final decision following the administrative hearing may be personally delivered to the person by the examiner or sent by first-class mail.

(7) Following a determination by the examiner that a person has committed the violation, the examiner may, consistent with the written guidelines established by the issuing agency, allow payment of the civil penalty in installments, or an issuing agency may allow for deferred payment or payments in installments, if the person provides evidence satisfactory to the examiner or the issuing agency, as the case may be, of an inability to pay the civil penalty in full. If authorized by the governing body of the issuing agency, the examiner may permit the performance of community service in lieu of payment of the civil penalty.

(8) If a notice of violation is dismissed following an administrative hearing, any civil penalty, if paid, shall be refunded by the issuing agency within 30 days.

22428. (a) Within 30 days after personal delivery or mailing of the final decision described in subdivision (c) of Section 22427, the contestant may seek review by filing an appeal to the superior court, where the case shall be heard de novo, except that the contents of the processing agency's file in the case on appeal shall be received in evidence. A copy of the notice of violation shall be admitted into evidence as prima facie evidence of the facts stated in the notice. A copy of the notice of appeal shall be served in person or by first-class mail upon the processing agency by the contestant. For purposes of computing the 30-day period, Section 1013 of the Code of Civil Procedure shall be applicable. A proceeding under this subdivision is a limited civil case.

(b) The fee for filing the notice of appeal shall be as provided in Section 70615 of the Government Code. The court shall request that the issuing agency's file on the case be forwarded to the court, to be received within 15 calendar days of the request. The court shall notify the contestant of the appearance date by mail or personal delivery. The court shall retain the fee under Section 70615 of the Government Code regardless of the outcome of the appeal. If the appellant prevails, this fee and any payment of the civil penalty shall be

promptly refunded by the issuing agency in accordance with the judgment of the court.

(c) The conduct of the hearing on appeal under this section is a subordinate judicial duty that may be performed by a commissioner or other subordinate judicial officer at the direction of the presiding judge of the court.

(d) If a notice of appeal of the examiner's decision is not filed within the period set forth in subdivision (a), the decision shall be deemed final.

(e) If the civil penalty has not been paid and the decision is adverse to the contestant, the processing agency may, promptly after the decision becomes final, proceed to collect the civil penalty under Section 22426.

22429. (a) A designated jurisdiction shall offer a diversion program for indigent speed safety system violation recipients, to perform community service in lieu of paying the penalty for an automated speed system violation.

(b) A designated jurisdiction shall offer the ability for indigent speed safety system violation recipients to pay applicable fines and penalties over a period of time under a payment plan with monthly installments of no more than twenty-five dollars ($25) and shall limit the processing fee to participate in a payment plan to five dollars ($5) or less.

(c) Notwithstanding subdivisions (a) and (b), a designated jurisdiction shall reduce the applicable fines and penalties by 80 percent for indigent persons, and by 50 percent for individuals 200 percent above the federal poverty level.

22430. Any designated jurisdiction that used speed safety systems shall, on or before March 1 of the fifth year in which the system has been implemented, submit to its local governing body and the transportation committees of the Legislature an evaluation of the speed safety system in their respective jurisdictions to determine the system's impact on street safety and the system's economic impact on the communities where the system is utilized. The report shall be made available on the internet websites of the respective jurisdictions and shall include all of the following information:

(a) Data, at least three months before and at least six months after implementation of each system, on the number and proportion of vehicles speeding from 11 to 15 miles per hour over the legal speed limit, inclusive, from 16 to 25 miles per hour over the legal speed limit, inclusive, 26 miles per hour over the legal speed limit, and for every violator traveling at a speed of 100 miles per hour or greater. Data shall also be collected on the average speed of vehicles and 85th percentile speed of vehicles. To the extent feasible, the data should be collected at the same time of day, day of week, and location.

(b) The number of notices of violation issued under the program by month and year, the corridors or locations where violations occurred, and the number of vehicles with two or more violations in a monthly period and a yearly period.

(c) Data, before and after implementation of the system, on the number of traffic collisions that occurred where speed safety systems are used, relative to citywide data, and the transportation mode of the parties involved. The data on traffic collisions shall be categorized by collision type and injury severity, such as property damage only, complaint of pain, other visible injury, or severe or fatal injury.

(d) The number of violations paid, the number of delinquent violations, and the number of violations for which an initial review is requested. For the violations in which an initial review was requested, the report shall indicate the number of violations that went to initial review, administrative hearing, and de novo hearing, the number of notices that were dismissed at each level of review, and the number of notices that were not dismissed after each level of review.

(e) The costs associated with implementation and operation of the speed safety systems, and revenues collected by each jurisdiction.

(f) A racial and economic equity impact analysis, developed in collaboration with local racial justice and economic equity stakeholder groups.

22431. This article shall remain in effect only until January 1, 2032, and as of that date is repealed.

SEC. 5. The Legislature finds and declares that Section 4 of this act, which adds Section 22425 to the Vehicle Code, imposes a limitation on the public's right of access to the meetings of public bodies or the writings of public officials and agencies within the meaning of Section 3 of Article I of the California Constitution. Pursuant to that constitutional provision, the Legislature makes the following findings to demonstrate the interest protected by this limitation and the need for protecting that interest:

To protect the privacy interests of persons who are issued notices of violation under a speed safety systems pilot program, the Legislature finds and declares that the photographic, video, or other visual or administrative records generated by the program shall be confidential, and shall be made available only to alleged violators and to governmental agencies solely for the purpose of enforcing these violations and assessing the impact of the use of speed safety systems, as required by this act.

SEC. 6. The Legislature finds and declares that a special statute is necessary and that a general statute cannot be made applicable within the meaning of Section 16 of Article IV of the California Constitution because of the unique circumstances with traffic speed enforcement in the Cities of Los Angeles, San Jose, Oakland, Glendale, and Long Beach, and the City and County of San Francisco.

01
Worksession Item

Office of the City Manager

WORKSESSION
March 14, 2023

To: Honorable Mayor and Members of the City Council

From: Dee Williams-Ridley, City Manager

Submitted by: Jennifer Louis, Interim Chief of Police

Subject: **Berkeley Police Department Annual Report**
2022 Year End Data Reports

INTRODUCTION

At the request of City Council, the City Manager provides regular reports on crime in Berkeley. This report details the year end crime, collision, stop data and use of force data for 2022. Status updates will also be provided on several Council referral items and department initiatives.

CURRENT SITUATION AND ITS EFFECTS

CALLS FOR SERVICE

In 2022 Berkeley Police Department received a total of 62,245 calls for service (CFS). This closely mirrors the call volume reported for 2021 (60,393 total), as calls for service have not returned to pre-pandemic levels to date. BPD has received an average 71,113 CFS per year for the past 7 years.

CRIME DATA

Part One Crimes

In 2022, total Part One crime in Berkeley increased by 15.4% overall from the year prior**.** Part One Violent Crimes increased by 134 cases and Part One Property Crimes

increased by 826 cases. The largest percentage increases in Part One Crimes were seen in Sexual Assault (56.1%), Aggravated Assault (34.3%), and Burglary (29.0%). Decreases were seen in Auto Theft (-23.9%) and Arson (-27.8%).

Part One Crimes Comparison

	2021	2022	Change	%Change
HOMICIDE	0	3	3	+3
RAPE	57	89	32	56.1%
ROBBERY	265	292	27	10.2%
AGG ASSAULT	210	282	72	34.3%
TOTAL VIOLENT CRIMES	**536**	**666**	**134**	**25.2%**
BURGLARY	803	1036	233	29.0%
LARCENY	3736	4611	875	18.9%
AUTO THEFT	1098	836	-262	23.9%
ARSON	72	52	-20	27.8%
TOTAL PROPERTY CRIMES	**5709**	**6535**	**826**	**14.5%**
TOTAL PART ONE CRIMES	**6241**	**7201**	**960**	**15.4%**

The following chart provides historical crime data for Part One Crimes from 2013 through 2022:

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Homicide	4	3	1	2	1	1	0	5	0	3
Sexual Assault	26	35	44	54	83	65	74	47	57	89
Robbery	410	263	330	361	364	353	369	274	265	292
Aggravated Assault	122	130	155	185	218	167	175	210	210	282
Burglary	1055	932	1090	805	843	829	771	797	803	1036
Larceny	3658	3615	4099	3965	4556	4004	4993	3933	3736	4611
Auto Theft	664	555	717	650	621	548	492	805	1098	836
Arson	16	15	22	24	30	31	17	52	72	52
TOTAL	**5955**	**5548**	**6458**	**6046**	**6716**	**5998**	**6891**	**6123**	**6241**	**7201**

Part One Crimes per Capita:

With a population of 117,684 in 2022, there were 612 part one crimes overall per 10,000 residents. There were 57 violent crimes per 10,000 residents and 555 property crimes per 10,000 residents.

Using the latest publicly available DOJ data, we know that in 2021, there were 47 violent crimes and 219 property crimes reported for every 10,000 residents in California. Also, in 2021, Oakland (pop. 433,823) reported 145 violent crimes and 582 property crimes per 10,000; San Leandro (pop. 88,868) reported 56 violent crimes and 380 property crimes per 10,000 residents; Santa Clara (pop. 127,151) reported 23 violent crimes and 276 property crimes per 10,000 residents.[1]

Gun Violence and Firearm Seizure:

The total number of shootings rose slightly in the City of Berkeley in 2022. During this reporting period there were 53 confirmed shooting incidents versus 52 in 2021. Confirmed shooting incidents include witnessed events as well as loud report calls where shell casings or other evidence of gunfire was found. In 2022, BPD's closure rate for shootings was 38% despite the fact that many incidents are heard only or have few witnesses or leads. Forensic and electronic evidence, diligent and detailed investigative efforts, as well as community willingness to share information was critical to developing leads and chargeable cases.

SHOOTINGS	2018	2019	2020	2021	2022
TOTAL	20	28	40	52	53
Cases Closed	11	9	23	24	20
Cases Charged	6	6	15	15	17

In 2022 there were a total of 119 firearms recovered by BPD, which was an increase of 1%. In 2022, 34 of the firearms seized were ghost guns compared to 33 in 2022 and 6 in 2020.

FIREARM RECOVERY METHODS	2019	2020	2021	2022
Patrol calls for service	33	36	51	64
Patrol proactive traffic stops	25	17	24	12
Detective Follow-up investigation	29	32	43	43
TOTAL	**87**	**85**	**118**	**119**

[1] State of California Department of Justice - OpenJustice

Robbery:

Total robbery cases continue to remain below pre-pandemic levels. The most notable change during 2022 was the increase in the number of pedestrian robberies.

ROBBERY CASES	2018	2019	2020	2021	2022
Pedestrian	229	247	131	119	148
Commercial	108	97	117	118	117
Home Invasion	5	4	8	8	8
Bank	3	2	5	6	4
Carjacking	10	14	13	14	15
TOTAL	**355**	**364**	**274**	**265**	**292**

Hate Crimes:

In 2022 there were 38 incidents of hate crimes, down from 42 in 2021. Hate Crime reports continue to be primarily reported as crimes of intimidation (either by using slurs or by leaving graffiti) rather than crimes of violence.

HATE CRIMES	2018	2019	2020	2021	2022
Race/Ethnicity/National Origin	11	5	7	29	24
Religion	3	1	2	11	3
Sexual Orientation	3	2	1	2	11
Gender	1	0	2	0	0
Disability	0	0	0	0	0
TOTAL	**18**	**8**	**12**	**42**	**38**

The Department led a coordinated multi-city department response to the Council referral item on improving hate crimes reporting and response. Several recommendations were completed including a public-facing mapping tool for hate crimes, a public outreach video in collaboration with the Mayor and PAB, ongoing relationships with at-risk communities, and connections with BUSD and UCPD staff. BPD provided a Council update on progress on this referral in November of 2022. Work continues on developing additional partnerships with targeted groups and creating a multi-lingual public outreach video.

Additional Property Crimes:

In addition to the Part One Property Crimes data provided above, additional Property Crimes data is as follows:

	2019	2020	2021	2022
Catalytic Converter Thefts	150	523	477	995*
Auto Burglary	2473	1042	1021	1288

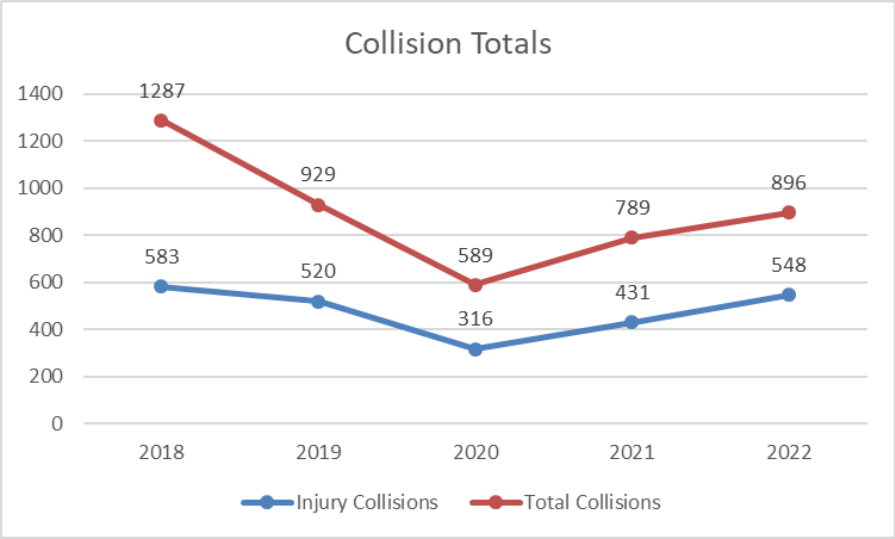
*The total for 2022 includes attempted catalytic converter thefts and reports of damage. In 2022, 809 catalytic converters were reported stolen.

COLLISION DATA

In 2022, there were a total of 896 collisions. They included, 548 injury and 346 non-injury collisions. Total collisions increased by 107, or 13.6% from 2021. Non-injury collisions decreased by 1.4% and fatal collisions decreased by 71.4%. Injury collisions increased by 27.2% and DUI collisions increased by 35.9%.

COLLISIONS	2019	2020	2021	2022
Fatal collisions	4	2	7	2
Injury collisions	520	316	431	548
Non-injury collisions	405	271	351	346
TOTAL collisions	**929**	**589**	**789**	**896**

The most common cause of collisions (the primary collision factor or PCF) was failure to yield right of way, unsafe speed, unsafe turn, and red-light violations. Bicyclists (114) and pedestrians (83) accounted for 36% of the injury collisions. Bicyclists were found at fault in 54 of the collisions and pedestrians in 10 of the collisions. A closer examination of the 54 at fault injury collisions involving a bicycle revealed 16 involved a solo bicyclist falling or hitting an object. There have been 47 right of way violations that have caused injury to a pedestrian this year.



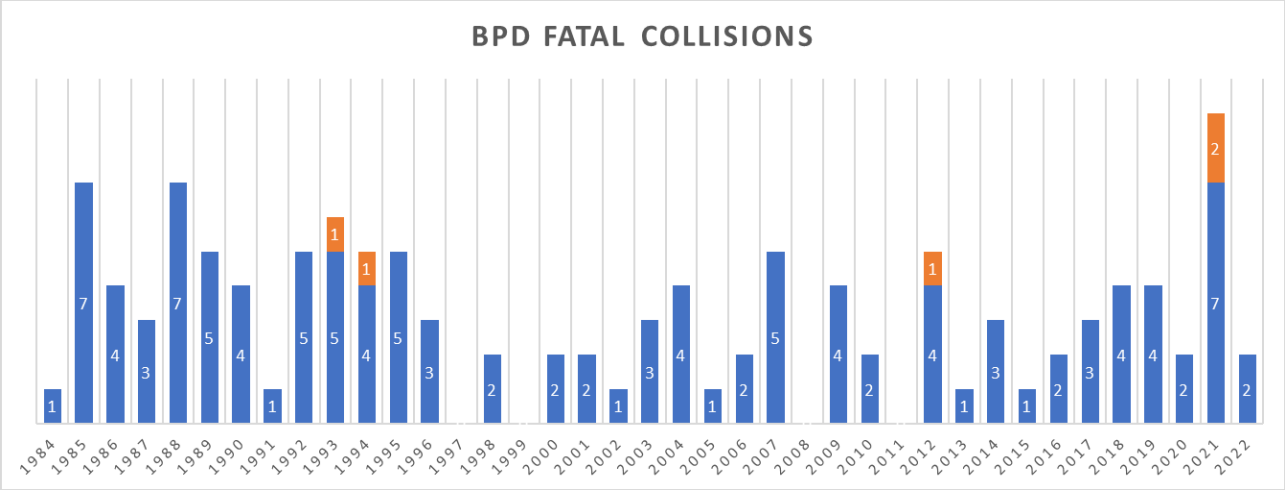
Of the two fatal collisions in 2022, one involved a pedestrian and the other a solo motorcyclist versus a fixed object (where alcohol was a factor). Additionally, 53 collisions involved a DUI driver (an increase from 39 in 2021) which resulted in 25 injuries. There have been 47 right of way violations that have caused injury to a pedestrian this year.

The two intersections which accounted for the highest number of collisions were Shattuck Ave and Haste St and Ashby and Shattuck Avenues (tied with 12 collisions each). The top twelve intersections where collisions occurred were:

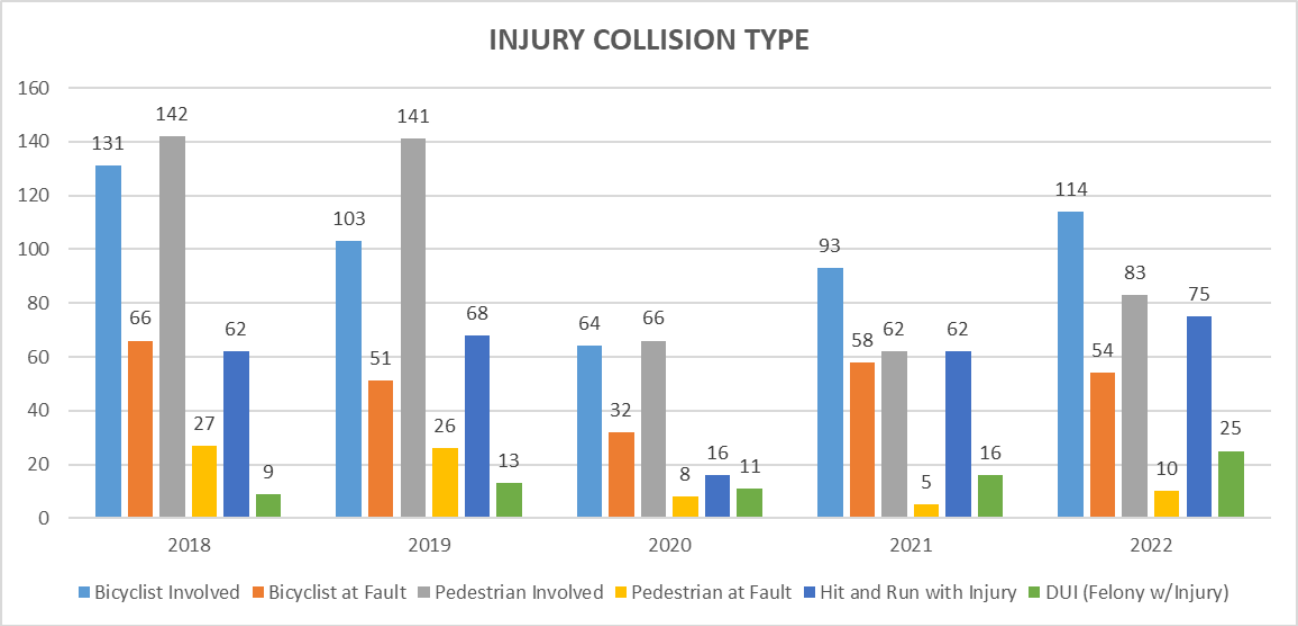
COLLISION INTERSECTIONS	Total Collisions	Injury Collisions	# of People Injured	Suspected Serious Injury
Shattuck Ave / Haste St	12	10	14	2
Ashby Ave / Shattuck Ave	12	9	10	2
Ashby Ave / San Pablo Ave	11	6	14	1
Ashby Ave / Sacramento St	11	6	6	0
University Ave / 6th St	10	4	5	0
MLK Jr Way / Ashby Ave	10	5	5	0
University Ave / Acton St	8	4	6	1
Dwight Way / Sacramento St	6	4	5	0
San Pablo Ave / Cedar St	5	2	2	0
University Ave / MLK Jr Way	5	5	6	1
Ashby Ave / College Ave	5	5	6	0
Shattuck Ave / Dwight Way	5	2	2	0

- Suspected serious injury is any injury other than a fatality that results in significant injury as defined in the CHP Collision Investigation Manual (CHP, 2017, p. 5-5)

The following provides historical data on fatal collisions in the City of Berkeley:



As previously stated, bicycles were involved in 114 of the injury collisions and pedestrians were involved in 83. Right of way violations affected pedestrians in 47 of those collisions. The primary collision factor was found to be the bicyclist in 54 collisions, the pedestrian in 10 collisions and DUI in 25 collisions.



BPD applied for and was awarded grant funding that supports our efforts to reduce traffic collisions and impaired driving in Berkeley. Grant sources include the Office of Traffic Safety (Selective Traffic Enforcement Program / STEP Grant) and the California Highway Patrol Cannabis Tax Fund Grant to provide additional enforcement, education and traffic safety programs. The funding allows us to standup DUI checkpoints, DUI patrols and provide enforcement in locations identified as high collision areas targeting dangerous driving behavior. Grant funding allows officers to attend training to become proficient in field sobriety testing to detect both alcohol and drug impairment. In partnership with OTS and other law enforcement agencies throughout the state BPD participates in national campaigns such as pedestrian safety month, winter DUI mobilization, distracted driving awareness, bicycle safety, motorcycle safety, walk to school day and click it or ticket enforcement.

A 2020 survey from the AAA Foundation for Traffic Safety found that people who drove more than usual during the pandemic were more likely to engage in risky behaviors including reading text messages, speeding, running red lights on purpose, aggressively changing lanes, not wearing seat belts, or driving after having consumed alcohol or cannabis. According to the National Highway Traffic Safety Administration (NHSTSA) traffic fatalities decreased in 2022 overall; however, pedestrians, motorcyclists and bicyclist fatalities were up.

Currently, there are two full time traffic enforcement (motorcycle) officers, one data analyst, one sergeant and one lieutenant assigned to the Traffic Bureau. With three

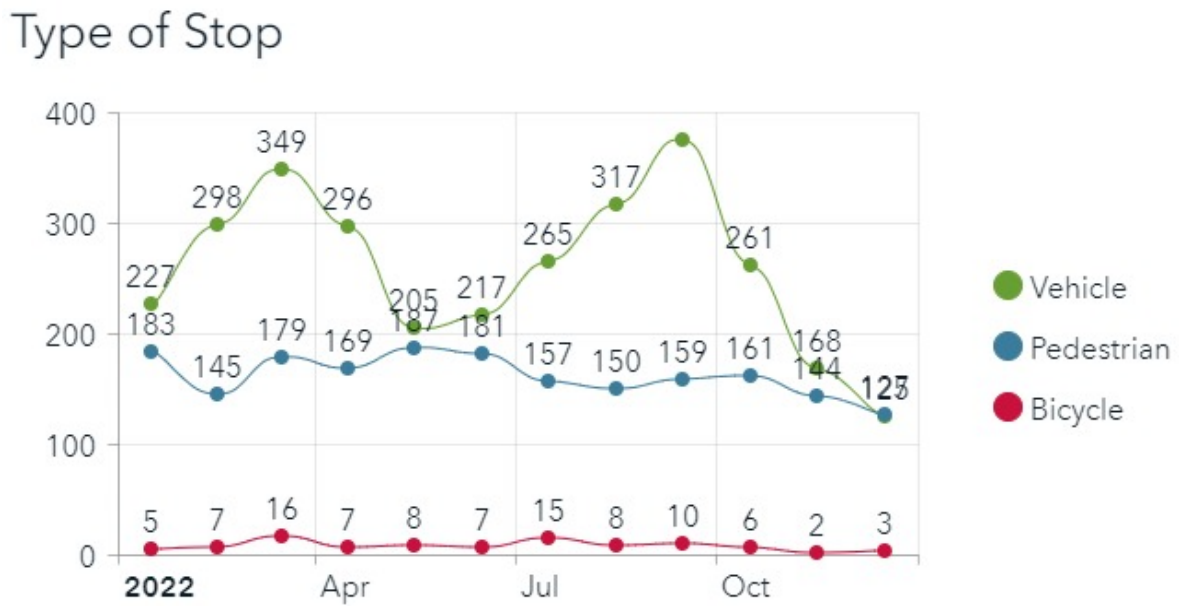
officers short, the Traffic Bureau issued 38% of all moving violations for the department. Staffing shortages within BPD have made enforcement of dangerous driving behaviors challenging.

The BPD has reprioritized traffic enforcement efforts around a three-prong approach that focuses on primary collision factors, community member reports and observations reported to the BPD and community caretaking. Community caretaking functions consider safety violations that aren't always noted as the primary collision factor but can be a significant contributing factor in serious collisions. The BPD will continue to collect, analyze collision data to understand and guide needs, the effectiveness of enforcement strategies and shape future deployment and resource allocation.

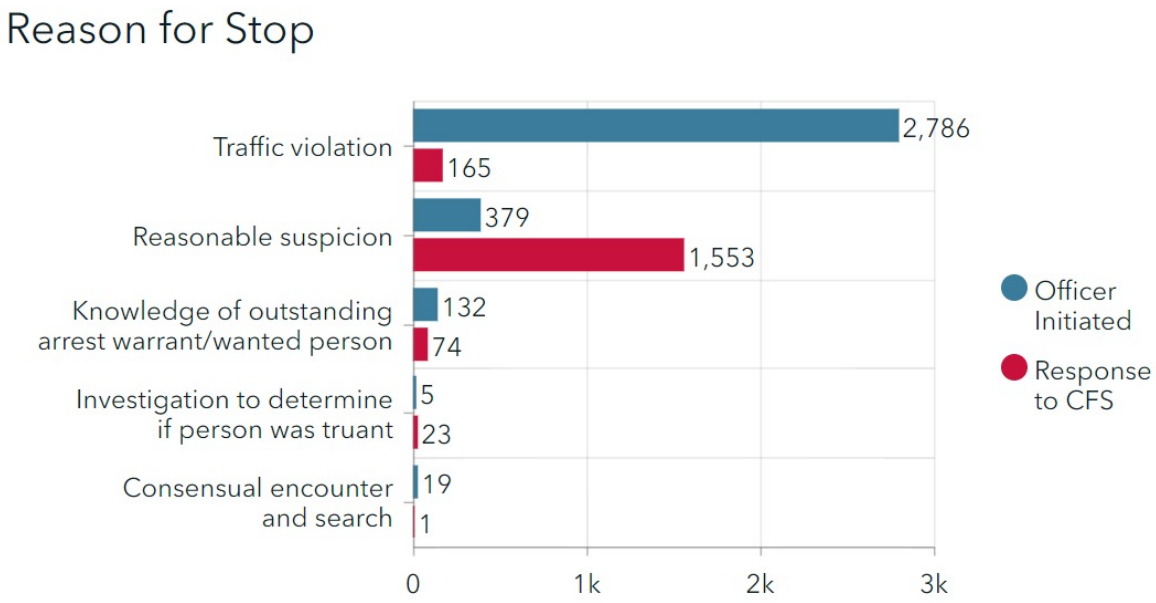
STOP DATA REPORT

In October 2020, the Berkeley Police Department began tracking and ultimately supplying the State of California with our stop data pursuant to the Racial Identity Profiling Act (RIPA). BPD began this data collection a full two and a half years before agencies our size were required to comply with RIPA. Berkeley began this process early as part of the department's efforts to better capture, understand and share the data associated with our stops.

During 2022, BPD averaged 258 vehicle stops, 162 pedestrian stops, and 8 bicycle stops per month for a 2022 total of 3,101 vehicle stops, 1942 pedestrian stops, and 94 bicycle stops. Here's the monthly breakdown:

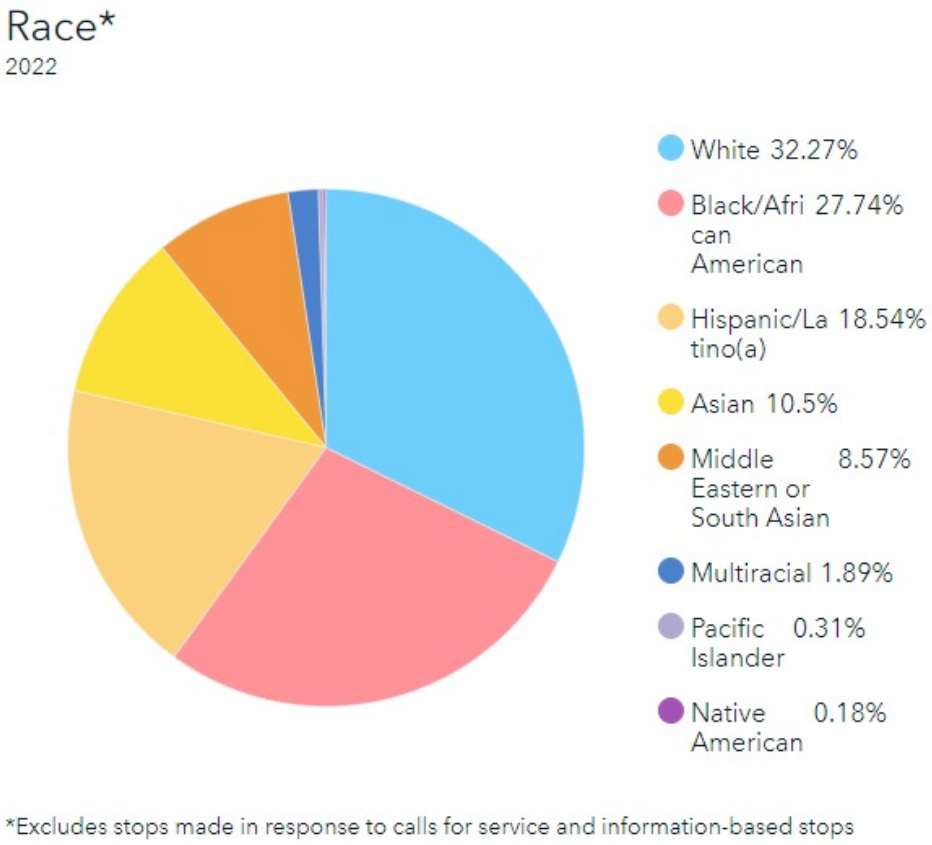


Overall, the majority of all of our stops (64.67%) were self-initiated and focused on traffic violations. The remaining 35.33% of our stops were in response to a call for service. The following graph outlines the reasons for the stop, with blue bars representing self-initiated activity and red bars indicating a response to a call for service.



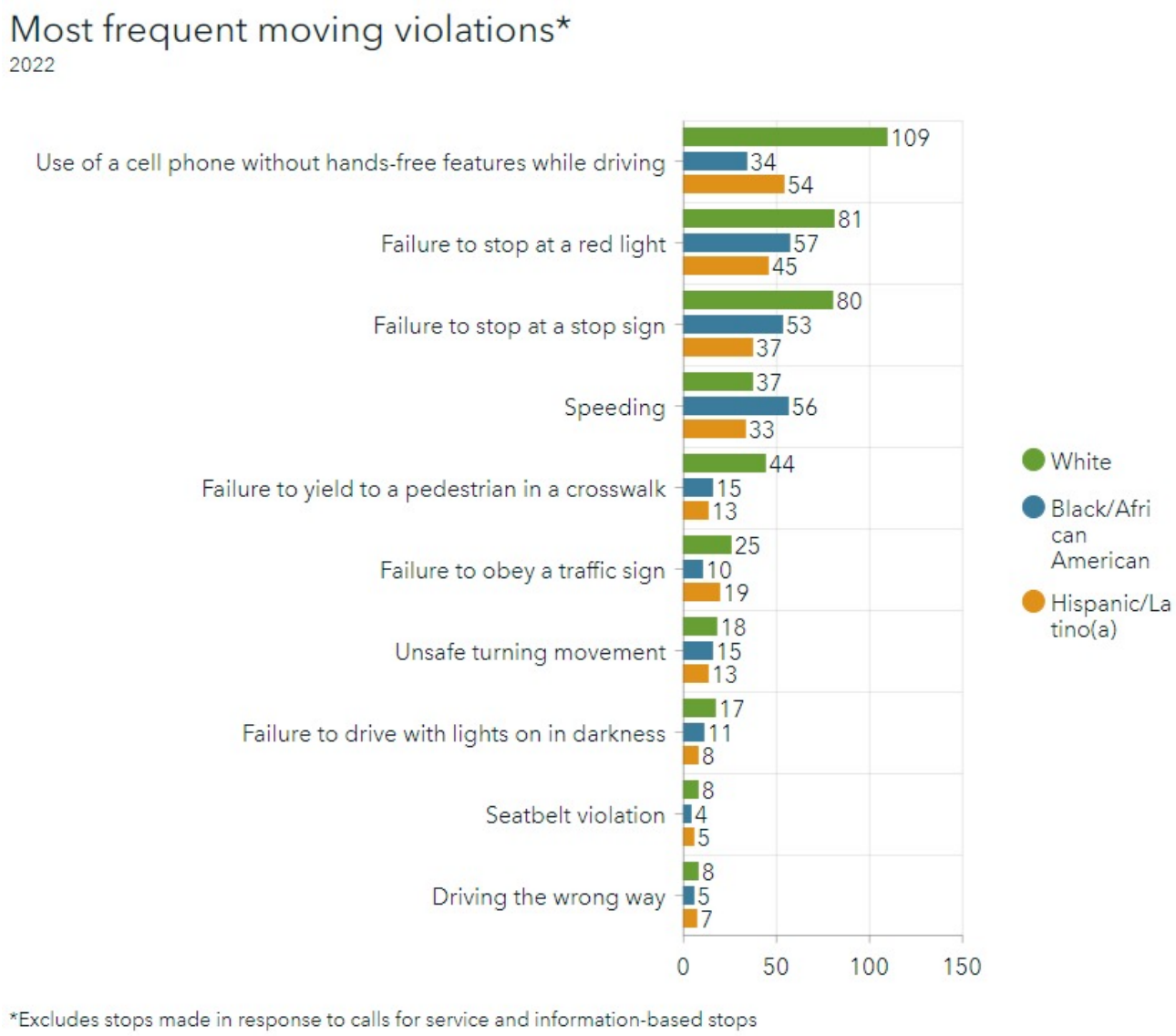
The table below outlines the moving violations associated with our stops. The violations related to this year's stop data correlate with primary collision factors (discussed earlier in this report), as well as other serious traffic safety violations geared toward community caretaking.

A review of the stop demographics excluding stops made in response to calls for service and information-based stops over the last year showed White individuals made up 32.27% of those stops, Black individuals made up 27.74%, and Latinx 18.54%. Further, 51.12% of those stopped were not Berkeley residents.



*Excludes stops made in response to calls for service and information-based stops

The chart below again looks at the moving violations associated with our stops and breaks down how they compare among different demographic groups.



RIPA data entry also allowed us to capture information about search rates. In 2022 BPD's search rate for all stops was 20% and had an overall contraband yield rate of 51%. Those searches resulted in the seizure of 92 weapons, including 16 firearms.

One method of determining whether officer discretion is influenced by implicit racial bias is to measure whether the officer's decision to search is subject to a lower threshold of suspicion for Black and Brown people as compared to for White people. Often called yield rate analysis, the method assumes that race-neutral indicators observable by an officer will accurately predict the probability that a search will turn up contraband. The logic follows that a search triggered by a given level of suspicion based on race-neutral

factors will 'yield' contraband at the same rate across racial groups. Conversely, a lower yield rate for searches of White people as compared to searches of Black people would indicate that officers are deciding to search White people when they have a higher confidence of finding contraband.

Breaking down the demographic and contraband yield rate by race reveals the following:

- Black 28% search rate 51% yield rate
- White 20% search rate 50% yield rate
- Hispanic/Latino(a) 17% search rate 59% yield rate

The 1:1 yield rate ratio for searches of Black and White subjects suggests that officers are making decisions to search based on race-neutral factors.

USE OF FORCE REPORT

Berkeley Police Department takes pride in our ability to accomplish our work with minimal reliance on force through approaches that include de-escalation techniques, as well as an awareness of mental health crisis issues and appropriate responses. The department reinforces these skills and strategies through regular training.

A review of the Berkeley Police Department's use of force statistics reflects the department's commitment to using minimal force. Data covering January 2015 through December 2022 shows the department responded to an annual average of 71,113 calls for service per year and effectuated 2,765 arrests. Under the department's prior reporting standards, there was an average of 75 uses of force per year.

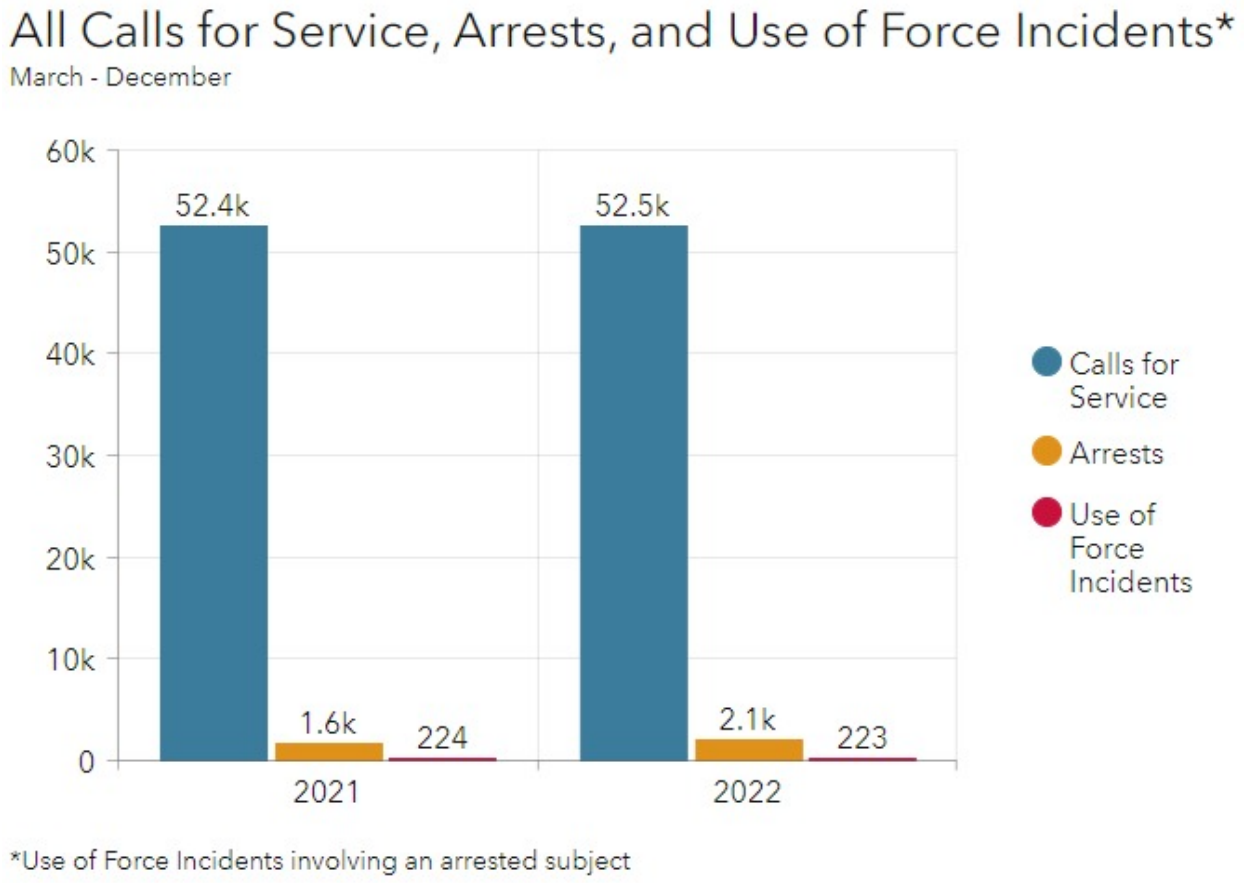
In February 2021, BPD transitioned to a new Use of Force Policy that had several substantial changes, that included a de-escalation requirement and an expanded use of force reporting standard. Under this policy, reportable force is delineated into the following four categories:

- Level 1 – Involves grabs, control holds, the use of leverage, or body weight with no injury or complaint of pain.
- Level 2 – Applies when an officer points or deploys a firearm while interacting with someone. It also applies to a Level 1 force that involves more than momentary discomfort but does not have an injury or complaint of pain.
- Level 3 – Parallels our old Use of Force reporting standard and involves the use of a weapon, subject injury, or complaint of pain. This category also applies to specific circumstances when an officer does not activate their body-worn camera.
- Level 4 – Applies when an officer uses a firearm or when there is an in-custody death.

The department use of force policy requires officers to report uses of force to their sergeant, who documents these incidents in a formal report. A lieutenant and captain

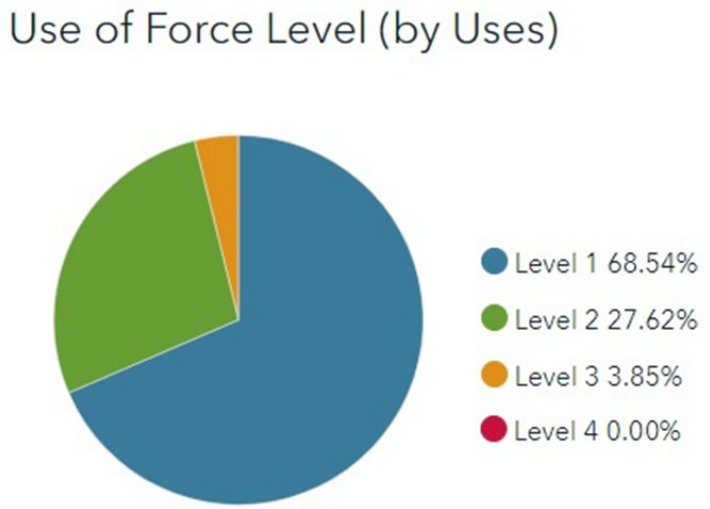
review each report, including associated body worn camera (BWC) footage, before forwarding it to Internal Affairs. In a given incident, more than one technique or type of force may be used to bring a resistant or combative individual into custody, and more than one officer may use force during the incident.

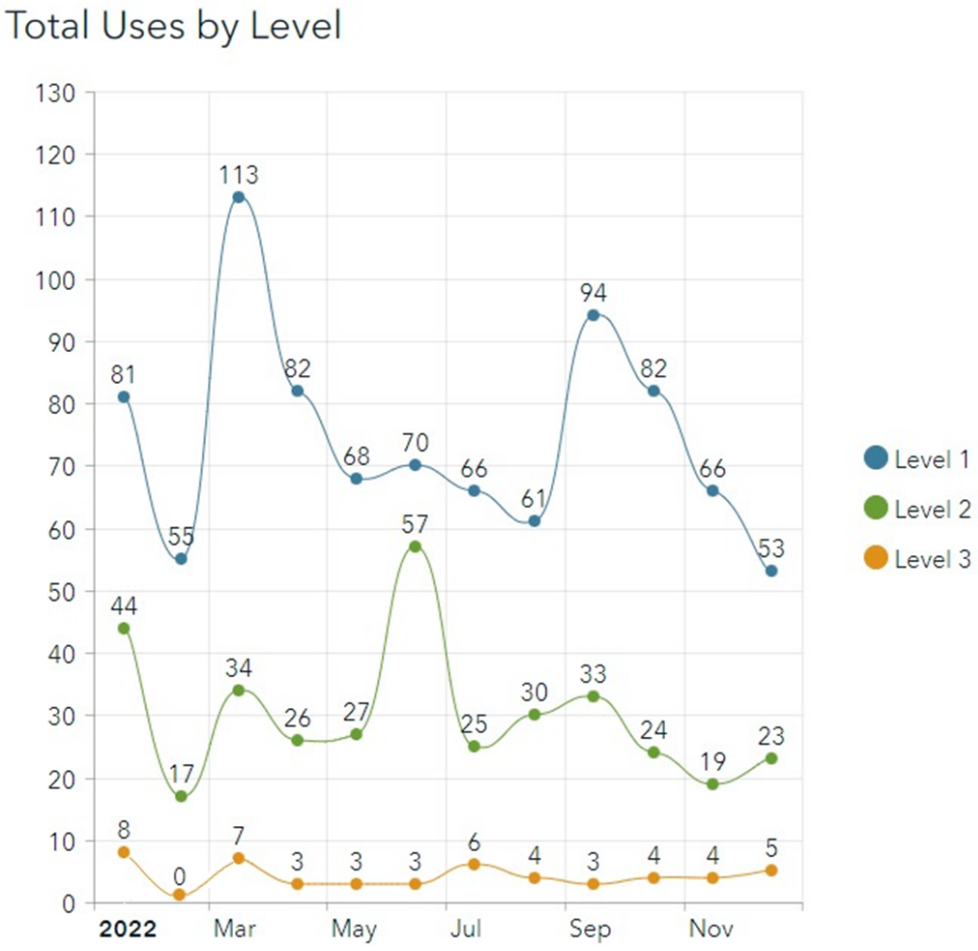
During 2022 there were 62,245 Calls for Service and 2478 arrests. Under the new reporting standard, in 2022 there were 369 incidents that involved 1301 uses of force. Of the 369 incidents where force was used, 68.5% were Level 1 uses of force, and 27.6% were level two. These two categories accounted for 96.1% of uses of force, demonstrating BPD officers' commitment to using minimal force when it is required. The department started capturing our updated use of force data in March of 2021, the Chart below compares our 2022 statistics for the same time period.



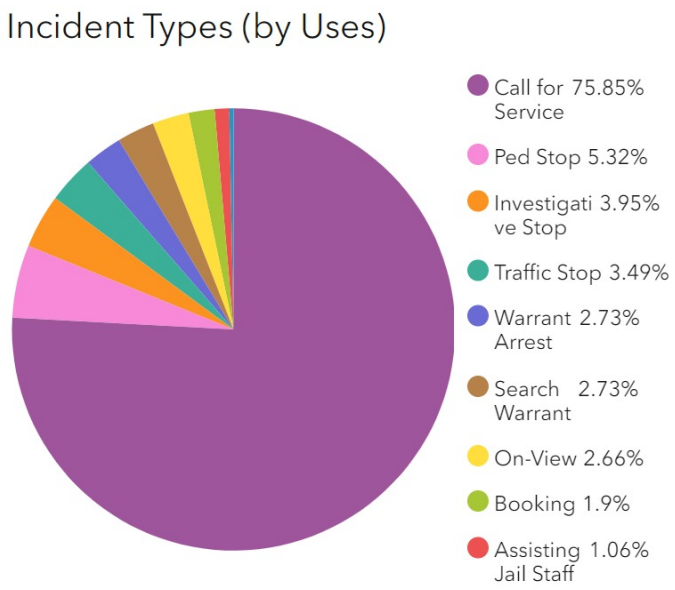
*Use of Force Incidents involving an arrested subject

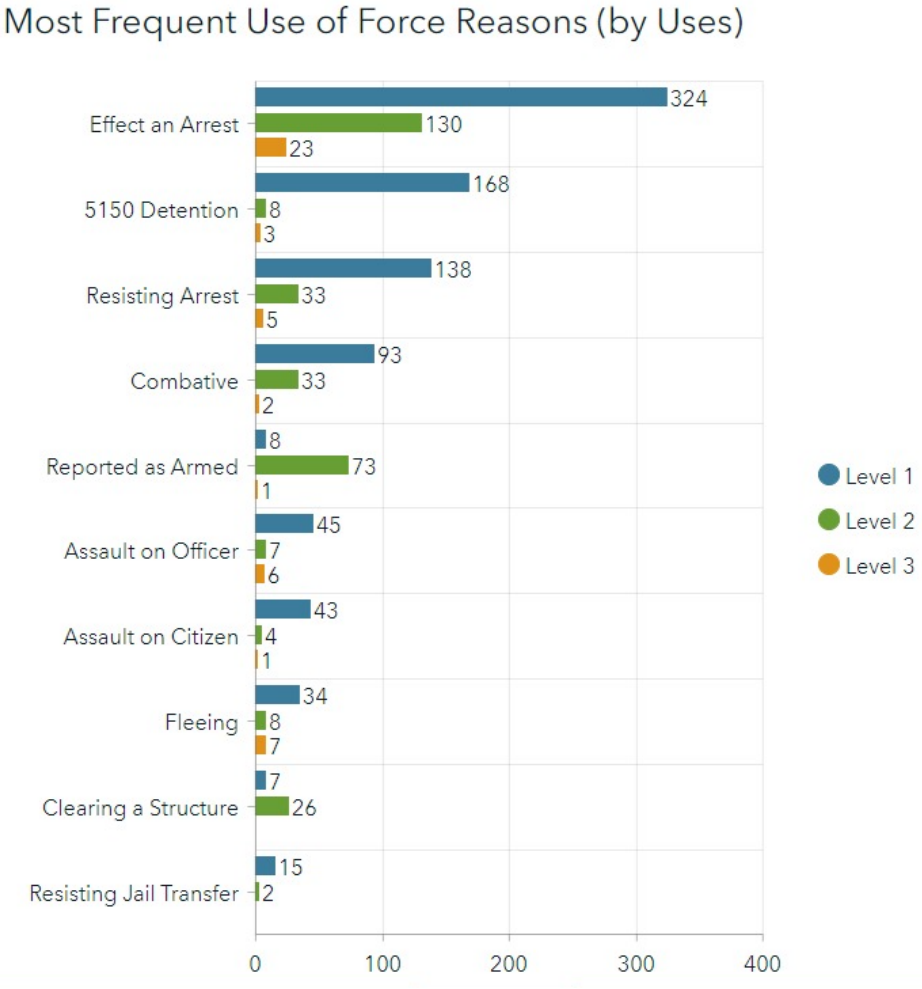
While the department has consistently evaluated individual use of force incidents, our expanded data collection and analysis tools allow us to understand and evaluate our use of force trends and share them with the community. We also use this information to help inform our policies and training. Here is a summary of our key findings:



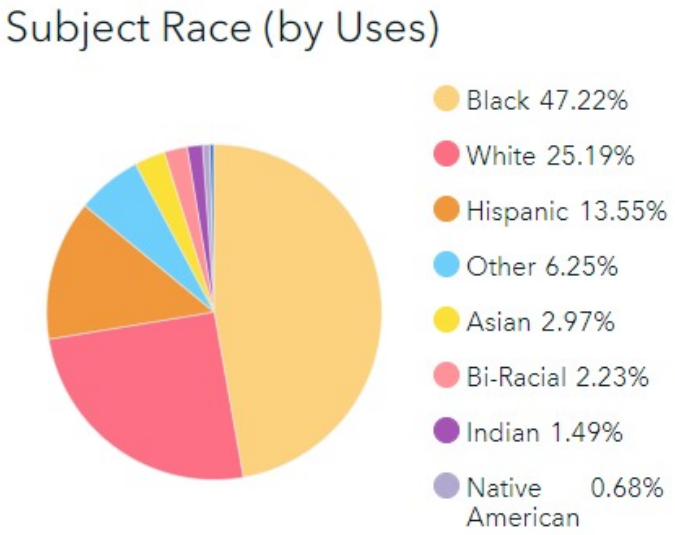


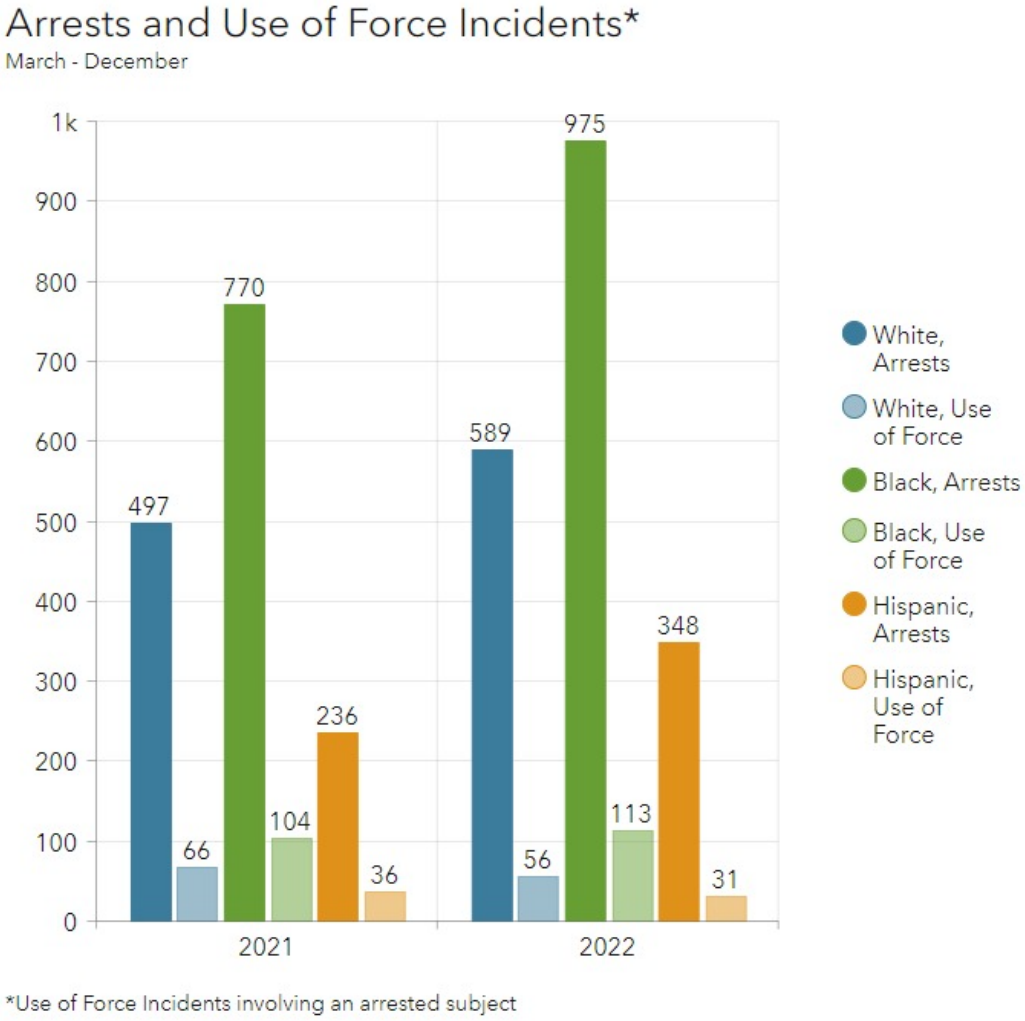
Data indicates that the majority of our uses of force occurred when officers responded to calls for service from the community. Use of Force occurred most often in relation to arrests and the majority of the force incidents involved the lowest level of force.


Incident Types (by Uses)
Call for Service 75.85%
Ped Stop 5.32%
Investigative Stop 3.95%
Traffic Stop 3.49%
Warrant Arrest 2.73%
Search Warrant 2.73%
On-View 2.66%
Booking 1.9%
Assisting Jail Staff 1.06%


Most Frequent Use of Force Reasons (by Uses)
Effect an Arrest 324 130 23
5150 Detention 168 8 3
Resisting Arrest 138 33 5
Combative 93 33 2
Reported as Armed 8 73 1
Assault on Officer 45 7 6
Assault on Citizen 43 4 1
Fleeing 34 8 7
Clearing a Structure 7 26
Resisting Jail Transfer 15 2
0 100 200 300 400
Level 1
Level 2
Level 3

Demographic breakdown of uses of force:





This year's use of force trends parallel last year's, and show that BPD officers minimally use force and apply the lowest levels of force when circumstances require it. Of the 62,245 calls for service that BPD received in 2022, only 0.42% (266 incidents) resulted in a use of force incident, and only 0.03% (19) resulted in a use of force that produced more than a minor complaint of pain or where a weapon was used (Level 3 and 4). Additionally, trends show that calls for service account for a larger percentage of cases where force was used this year (75.85% versus 68.5%), much of which was attributed to a reduction in force incidents associated with investigative stops.

One of the other ways the department evaluates our responses is by tracking data associated with use of force complaints. While all of our use of force cases are always reviewed by a Lieutenant and Captain, those associated with a personnel complaint are also subject to an Internal Affairs Bureau (IAB) investigation. The results of the investigation (including BWC footage) are given to a Board of Review that evaluates the case and makes a recommendation to the Chief.

In 2022 the department received a total of five complaints associated with use of force incidents involving 19 applications of force. To date, three of those investigations have been completed while two are still being evaluated. Additionally, two out of those three cases were also independently assessed by the Director of Police Accountability and Police Accountability Board. None of the cases reviewed by the department or the DPA /PAB resulted in sustained findings of misconduct.

The department will continue to collect, evaluate, and assess our use of force data and use it to inform our policies and training with a focus on achieving positive outcomes.

DEPARTMENT PERSONNEL

The Berkeley Police Department prides itself on rigorous evaluation of police officer applicants, as well as hiring and training some of the profession's best officers who exemplify the Department's overall mission as well as the values of our diverse and vibrant City. Beyond the expectations to successfully complete training and education requirements, the Department demands that officers hold themselves to a departmental culture of integrity, respect and professionalism.

We are currently staffed at 150 sworn police officers, well below our current authorized staffing level of 181 sworn personnel. Three of those positions are held by recruit officers who are currently in academy training and will not reach solo officer status until Fall 2023. Twenty of the 150 officers are eligible to retire and several of them have stated an intent to retire over the course of 2023.

Berkeley Police Department currently is authorized 36 dispatch positions, and is currently staffed with 20 dispatchers and 4 dispatch supervisors. There are currently 5 dispatchers and 1 supervisor that are eligible to retire. The Communications Center is supported by several per diem and other dispatch qualified employees who alleviate some of the strain of understaffing. In a recent consultant report by Federal

Engineering, the recommendation is to increase the total staffing number from 36 to 60 employees (Section 6.2). The goals of the higher staffing number include ensuring the ability to provide Emergency Medical Dispatching (EMD), improve the span of control for supervisors, increase minimum staffing and creating a Training & Quality Assurance Coordinator position.

We are also in the process of hiring additional Community Service Officers (CSO). We are authorized 29 CSO and are currently staffed with 23. For the last several years we were authorized 22 CSO but six CSO and a CSO Supervisor were added to the Fiscal Year 2023 budget as a recommendation stemming from the reimagining public safety process. The additional CSO will be trained to respond to lower priority calls and a variety of tasks that would have traditionally fallen to a sworn officer. Community outreach and engagement will be part of the work of CSO as well. Staff has encountered difficulty identifying the scope of necessary training and attracting existing CSO to this developing position since it was only funded on a limited three-year term in the FY 2023 budget. The Department is committed to supporting this reimagining public safety goal and will continue work to develop this program.

Low staffing numbers challenge the department's ability to proactively address and solve problems in the community. It also negatively impacts morale and the overall wellness of the Department. The Department continues to actively recruit and work with Human Resources to facilitate open and continuous recruitments to reach full staffing of police officers and dispatchers. Furthermore, to help address the challenges associated with hiring, in 2022 the Department committed to the creation of a Recruitment and Retention Team. That team is comprised of officers and dispatchers who work with Personnel and Training on a part time basis to attend job fairs, work on our social media outreach, respond to applicants who submit interest cards and facilitate ride-alongs with officers and sit-alongs with dispatchers. In 2022, the Department worked on a Recruitment and Retention Incentive Program that was recently approved by City Council. The Department is currently working through the logistics and is excited about the potential the program provides for recruiting and retention.

CITY AUDITOR REPORTS

There are currently three open audits involving BPD that were produced by Auditor Wong and her staff;

1. 911 Dispatchers: Understaffing Leads to Excessive Overtime and Low Morale

2. Data Analysis of Berkeley's Police Response

3. Berkeley Police: Improvements Needed to Manage Overtime and Security Work for Outside Entities

The Department will be submitting audit updates to City Council in May 2023 regarding the three open audits. Working with the City Auditor's Office in this process, we anticipate completion of the first two audits before May with all items having been addressed. The third audit is not complete but we have made significant progress on the recommendations listed in the report. This includes the implementation of a significant technology project related to an electronic staffing software. We are eager to continue working with Auditor Wong's office to accomplish all of the recommendations in this budget related audit.

FAIR AND IMPARTIAL POLICING UPDATE

Implementing the FIP Task Force recommendations remains a priority of the Berkeley Police Department. The Professional Standards Division is responsible for managing the project of implementing the recommendations. This report provides a quarterly update on the implementation of the Task Force recommendations.

The FIP Task Force recommendations required the department to amend its policies and establish a number of new protocols. As part of the process, members of BPD engaged with the Mayor, Council and their representatives, the Police Review Commission (now the Police Accountability Board or PAB), FIP Task Force members, and the PAB Subcommittee on FIP recommendation implementation. During these meetings, BPD staff collaborated with and updated each group on the substance and progress of this important project.

The Berkeley Police Department remains committed to equitable and unbiased policing and we are proud to have implemented almost all of the FIP recommendations. A policy in the form of a special order has been released to ensure that current and future members of the Berkeley Police Department carry forward and build upon this important foundational work initiated by the Fair and Impartial Policing Task Force. Below are the updates since the last reporting period. Once the final recommendations of the referral are completed the Department will continue efforts related to fair and impartial policing and provide annual updates and progress in this report.

- *Recommendations related to: Implement Procedural Justice Reforms*

Pursuant to the FIP recommendation and after meeting with the FIP task Force stakeholders, language was added to the current Early Warning System (EWS) policy to include data around traffic, bicycle, and pedestrian stops as a category that supervisors will consider for early intervention if merited. This new EWS policy has been implemented.

Ongoing efforts include implementing new systems for the monitoring of officer's individual stop data by their respective supervisors. The Audits and Inspections Sergeant began conducting separate and random quarterly audits of officer's stop data,

complaints, uses of force incidents and other factors and report the findings to the Chief of Police. Results of these audits are provided to the Police Accountability Board.

- *Recommendations related to: Conduct a Capacity Study of police calls and responses and use of officer time outside of case work.*

The City's Auditor's report was released which analyzed Computer Aided Dispatch data. Recommendations from this analysis were provided to the Police Department and findings were referred to the Reimagine Public Safety Task Force. BPD has implemented the recommendations and an assessment of overall staffing levels as well as patrol beat specific analysis will be conducted as part of the sworn staffing assessment described above. This assessment will study our organizational structure, resource allocation, and geographical patrol boundaries.

Internally the Strategic Analysis Team has been directed to continue their work to refine the way and type of data that is collected, and analyze call response time to support the likely upcoming consultant work.

DEPARTMENT INITIATIVES

The Berkeley Police Department mission is to safeguard our diverse community through proactive law enforcement and problem solving, treating all people with dignity and respect. As discussed, the BPD is experiencing significant staffing issues in several critical classifications but especially in sworn officers and dispatchers. We forecast that recruitment and retention will be key to weathering unprecedented staffing pressures. Department initiatives underway support and guide this mission despite our expected challenges. Some of these are listed below:

Sworn Staffing Study:

Both the Re-imagine Policing work and Auditor's Audit on Police Overtime called for independent analysis of our workload, service demands, staffing levels, and allocation of resources. The Department opened a request for proposals from consultants that specialize in public safety staffing. All the bids received exceeded the current budget authority, which may affect the breadth of the analysis that we can complete. We are evaluating several proposals and will take the appropriate next steps to contract a consultant to advise on the long-term deployment of police services in Berkeley. We expect that work to inform decision-making as we rebound from a low point expected in the next year to 18 months. It should also help us to incorporate recommendations from the Re-Imagining Public Safety process.

In the meantime, the department is making adjustments to cope with low staffing. This has included reducing staffing in special assignments, delaying work on longer term

projects, and looking for additional ways to increase efficiencies. As the majority of the sworn personnel are deployed in our Operations Division as patrol officers, the department conducted analysis on call for service volume as it occurs throughout the day and week. Our existing 16 beat structure was deployed nearly a decade ago. At the time, it was balanced in terms of workload and service delivery. Over time, crime patterns and demands for services change. Further, our critically low staffing has made the 16-beat deployment difficult to staff requiring more forced overtime for our shrinking patrol resources. Our Strategic Analysis Team worked on a 14 beat map was able to create more efficiency and parity in service delivery and workload. The new structure should be more resilient to what we expect to be a very difficult year. The Patrol Operations division will transition to the new beat structure in April of 2023. The 14 beat project will also provide useful data for the sworn staffing study.

From Pilot to Best Practice: Recovery Officer

In response to multiple high-profile in-custody deaths, Berkeley Police Department officers have developed new ideas to improve their response to these challenging events. Central to these recommendations was a plan to reinforce the sanctity of life. In October of 2021, BPD identified a new role of Recovery Officer during certain in-progress incidents. This role has three basic objectives: improve scene management on incidents where an involved party has undergone extreme exertion, evaluate medical needs sooner, and decrease BFD response time so any necessary treatment can occur more rapidly. De-escalation wherever possible remains the department's goal. However, in those instances where de-escalation efforts fail, there will be a proactive plan to get the subject evaluation and care as soon as practical.

The Recovery Officer Pilot Program was launched with great success. We are currently studying the deployment to continue to improve the transition from physical altercation to care. Initial analysis suggests Officers are calling BFD Paramedics to more scenes involving physical altercations and have positively impacted response times. We couldn't have achieved the positive change without the support of the Berkeley Fire Department. The Strategic Analysis Team is partnering with use of force experts as well as Berkeley Fire Department to assess the practice, its impacts both qualitative (data, response times, outcomes) and quantitative (procedure, de-escalation, communication) to continue to develop and refine our practices around combative subjects. At the conclusion of the analysis, we will incorporate the practice into future trainings and formalize the approach in policy.

Reinforcing Best Practices: Duty to Intercede

Berkeley PD has had a “Duty to Intercede” policy for over a decade. Use of Force Policy (BPD Policy 300.1 - Use of Force) requires; “Whenever possible, officers shall intervene when they know or have reason to know that another officer is about to use, or is using, unnecessary force. Officers shall promptly report any use of unnecessary force and the efforts made to intervene to a supervisor.” Since, George Floyd’s death, Duty to Intercede is a fundamental training element in our use of force training scenarios. Officers are trained and expected to take decisive action to prevent abuse and to protect the sanctity of life. One example in 2022 was an eight-hour training session for our staff that covered use of force decision-making. Several scenarios and debriefs specifically covered the duty to intercede.

Improved Training for Sergeants

In the past year, we have increased training for supervisors in Patrol Operations. We have had mandatory leadership meetings with all patrol supervisors twice a year. These meetings improve clarity on leadership and help emphasize how we are leading during an unprecedented period of change in our industry. We have also introduced Operations Leadership Work Groups, where leaders solve problems, strategize, and deploy solutions to challenges. The BPD established several internal work groups to include develop data analysis tools supporting evidence-based policing strategies, update and realign our patrol officer and supervisor annual performance evaluations, evaluate alternative schedule deployments to better cope with critically low staffing, and improve training, departmental practice, and leadership around the use of Body Worn Cameras.

Strategic Analysis Team and Problem-Solving Approaches:
BPD has hired two analysts to further the goal of establishing a unit that focuses primarily on crime prevention, supporting investigative strategies, strengthening problem solving approaches and providing transparency to our community.

Referred to as the Data Analysis team in previous reports, the Strategic Analysis Team (2 data analysts and 1 officer) launched the Berkeley Police Transparency Hub in 2022 as part of an effort to enhance our communication with the community about our work. The Transparency Hub features the following data dashboards that the community can use to follow our work at their own leisure: Stop Data, Calls for Service, Use of Force and Crimes Data. The Transparency Hub contains a page for Community Engagement, so the community may follow the many events throughout the city in which BPD participates. Additionally, the Community Engagement page allows for community members to engage with BPD’s initiatives of Crime Prevention and Merchant Partnerships. A key tool utilized by BPD to support these initiatives is the multi-disciplinary survey assessment, Crime Prevention Through Environmental Design

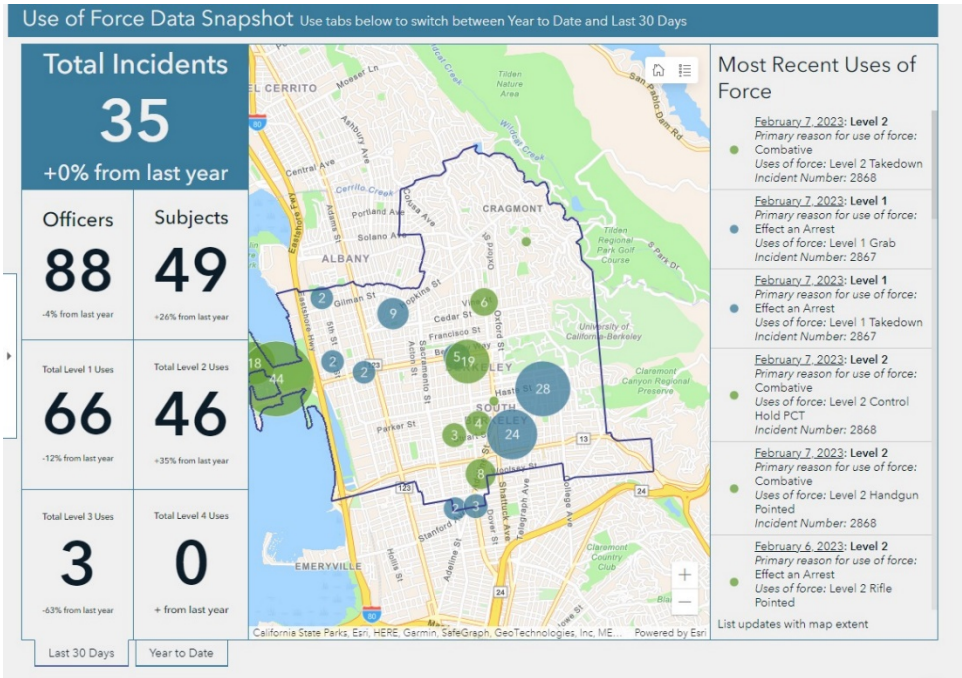
(CPTED). A CPTED survey can be requested online by any community member at any time. Finally, the Transparency Hub includes a page of Current Trends. This page contains specific data of interest to the community. Currently the page includes data related to the following topics: Gun Violence, Hate Crimes, Ghost Guns and Catalytic Converter Thefts. The Transparency Hub provides the transparency and accountability for BPD which the community demands.

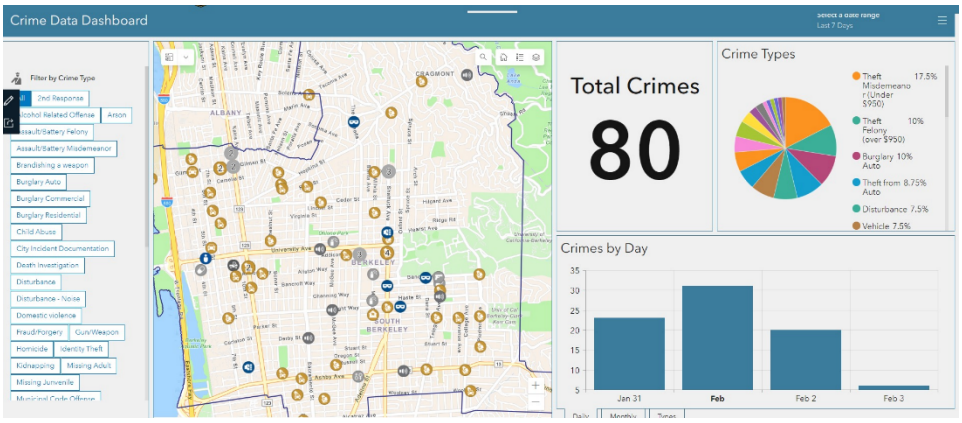
The Strategic Analysis Team also launched internal tools to assist officers' understanding of the people, locations and behaviors that most negatively impact public safety. The tools are specific to areas and people, updated daily and accessible to all officers. Additional internal tools include problem specific data for the following topics: Retail Crime, Catalytic Converter Theft and Traffic. The purpose of these internal tools is to provide officers with information to more accurately indicate the proper intervention for the problem with which they are faced. This may mean enforcement or collaboration with other providers and/or city partners.

The Strategic Analysis Team has provided BPD with the necessary tools to respond to people, locations and behaviors with the most appropriate, optimal and equitable interventions. The data and tools to provide the most appropriate, optimal and equitable interventions allows for a more positive BPD "footprint" within the community. As officers increase their work with these tools, we expect there to be increases in yield rates in the stop data, but an overall reduction in the total number of stops. Analysis of the effectiveness and impact of these efforts will be important and is ongoing.

Upcoming work from the Strategic Analysis Team includes the addition of a Traffic Data page to the Transparency Hub. The page will provide quarterly counts of collisions of all types and analysis of primary collision factors, as well as highlight BPD's ongoing work to reduce unsafe driving patterns.

The below screenshots are examples of what is found on the Transparency Hub for the community:



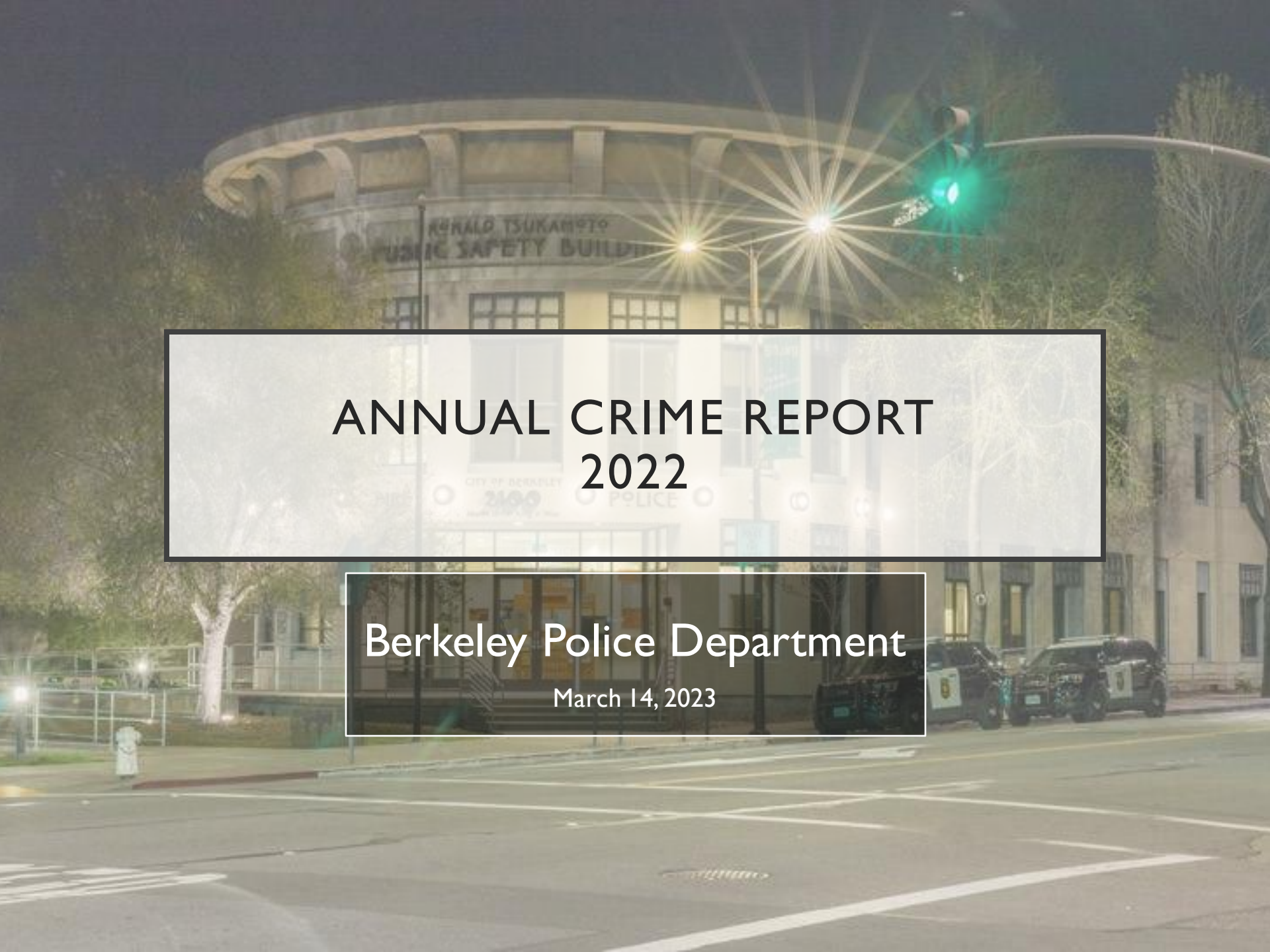


ENVIRONMENTAL SUSTAINABILITY

There are no identifiable environmental effects, climate impacts, or sustainability opportunities associated with the subject of this report.

CONTACT PERSON

Jennifer Louis, Interim Chief of Police, 981-5900



ANNUAL CRIME REPORT 2022

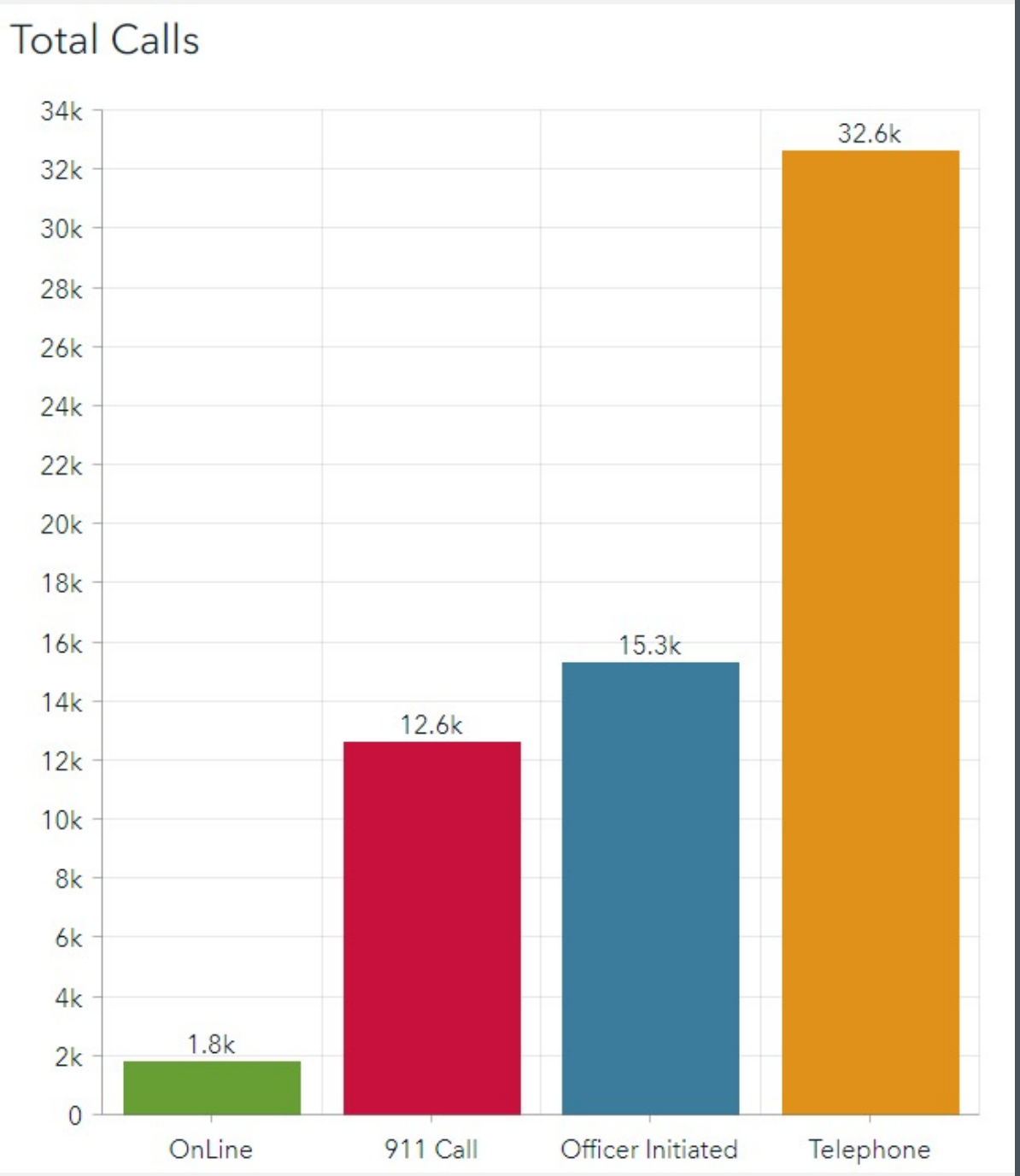
Berkeley Police Department

March 14, 2023

AGENDA

TIMEFRAME:
JANUARY 1 –
DECEMBER 31, 2022

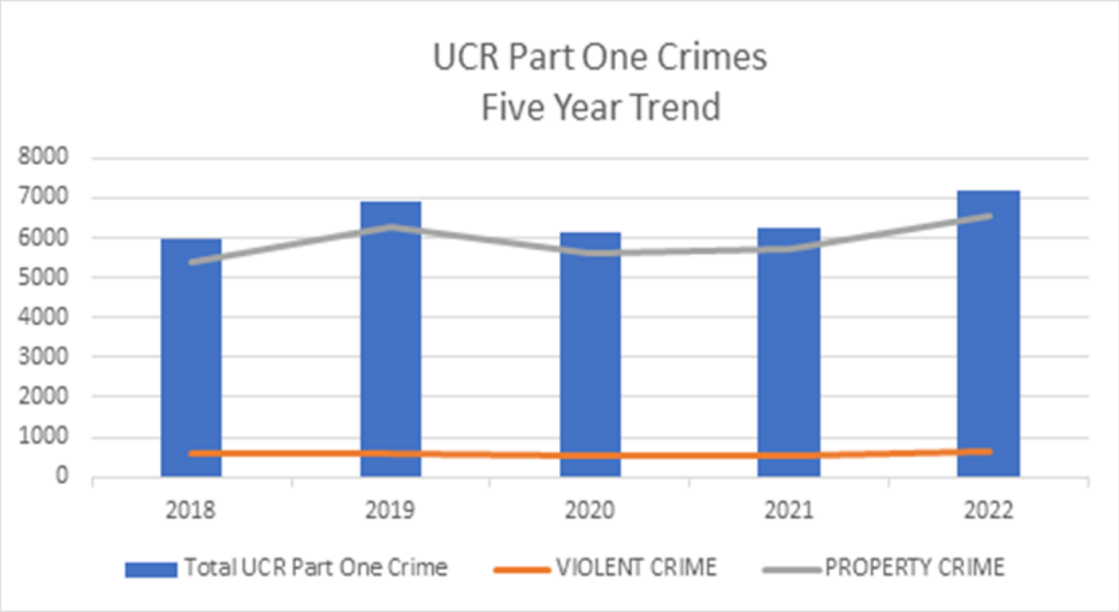
- Calls for Service
- Crime Data
- Collisions
- Stop Data
- Use of Force
- Department Personnel
- City Auditor Reports
- Fair and Impartial Policing Update
- Department Initiatives



CALLS FOR SERVICE

Calls for service follow recent trends

- In **2022** Berkeley Police received a total of **62,245 calls for service**.
- This closely mirrors the call volume reported for **2021** (**60,393** total)
- BPD has received an average **71,113** CFS per year for the **past 7 years**.



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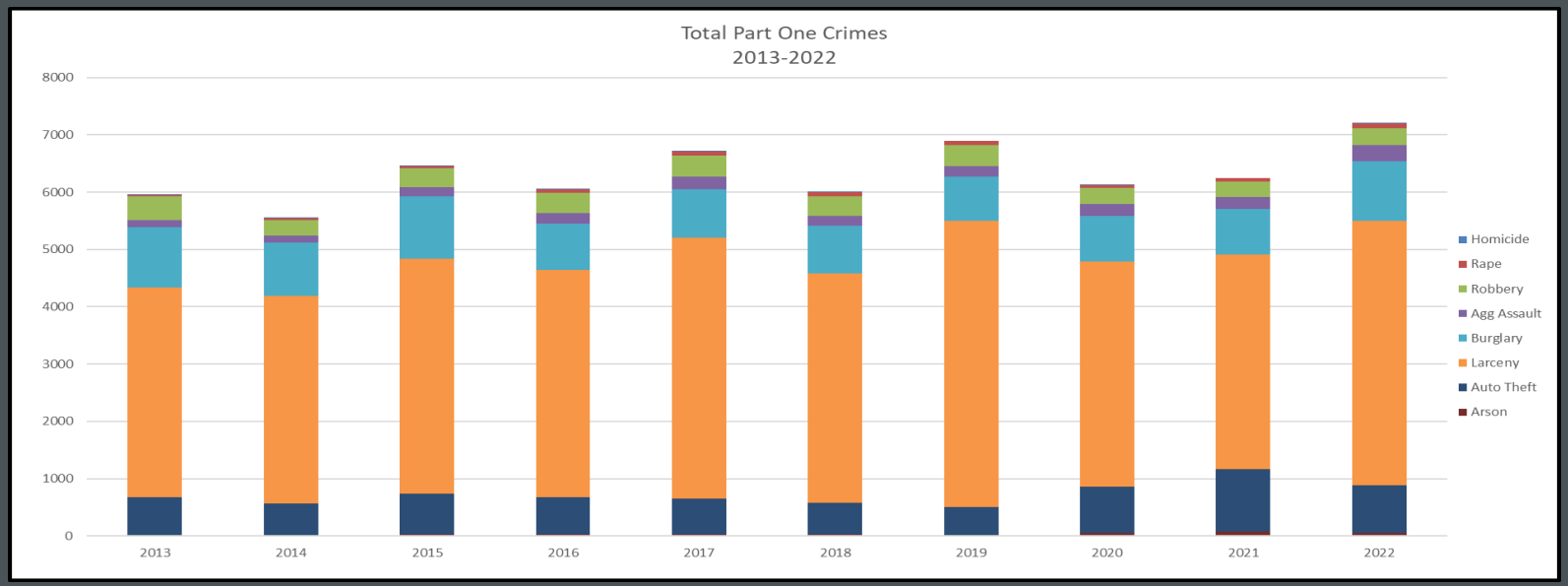
UCR Part One Crimes 2021 Comparison					
2021	Population	Total Violent	Total Property	Total Part One	Crime Rate*
Berkeley	**117,145**	**542**	**5,771**	**6,313**	**539**
Fremont	**227,514**	**469**	**5,694**	**6,163**	**271**
Hayward	**159,827**	**529**	**4,629**	**5,158**	**323**
Oakland	**433,823**	**6,300**	**25,482**	**31,782**	**733**
Richmond	**115,639**	**888**	**2472**	**3,360**	**291**
San Leandro	**88,868**	**498**	**3400**	**3,898**	**439**

CRIME SUMMARY

Both Property Crime and Violent Crime increased in 2022

- * Crime rate refers to crimes reported per 10,000 res idents.



Part One Crimes

	Homicide	Rape	Robbery	Agg Assault	Burglary	Larceny	Auto Theft	Arson	Total
2013	4	26	410	122	1055	3685	664	16	5955
2014	3	35	263	130	932	3615	555	15	5548
2015	1	44	330	155	1090	4099	717	22	6458
2016	2	54	361	185	805	3965	650	24	6046
2017	1	83	364	218	843	4556	621	30	6716
2018	1	65	353	167	829	4004	548	31	5998
2019	0	74	369	175	771	4993	492	17	6891
2020	5	47	274	210	797	3933	805	52	6123
2021	0	57	265	210	803	3736	1095	72	6241
2022	3	89	292	282	1036	4611	836	52	7201

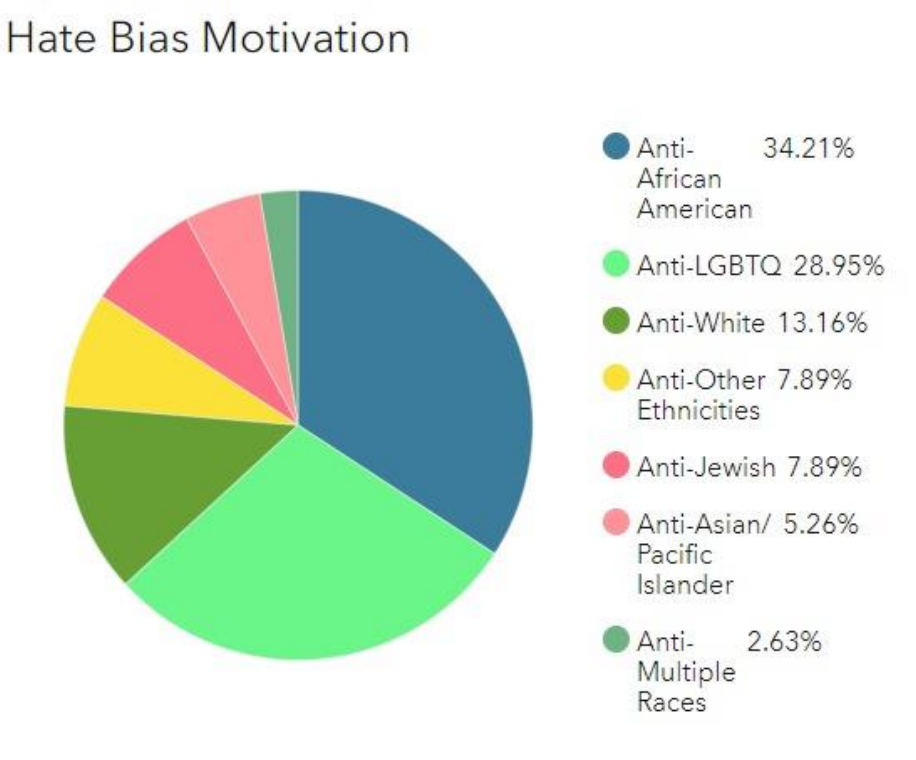
Shootings				
	Total	Homicides	Closed	Charged
2018	**20**	**0**	**11**	**6**
2019	**28**	**0**	**9**	**6**
2020	**40**	**4**	**23**	**15**
2021	**52**	**0**	**24**	**15**
2022	**53**	**3**	**20**	**17**

Firearm Recoveries			
	Patrol- call for service	Patrol- proactive	Detective- Investigation
2019	**33**	**25**	**29**
2020	**36**	**17**	**32**
2021	**51**	**24**	**43**
2022	**64**	**12**	**43**

CRIME SUMMARY

Shootings & Firearm Recoveries

- Guns are being recovered in all types of cases
- Most of the guns recovered by BPD are not legally possessed

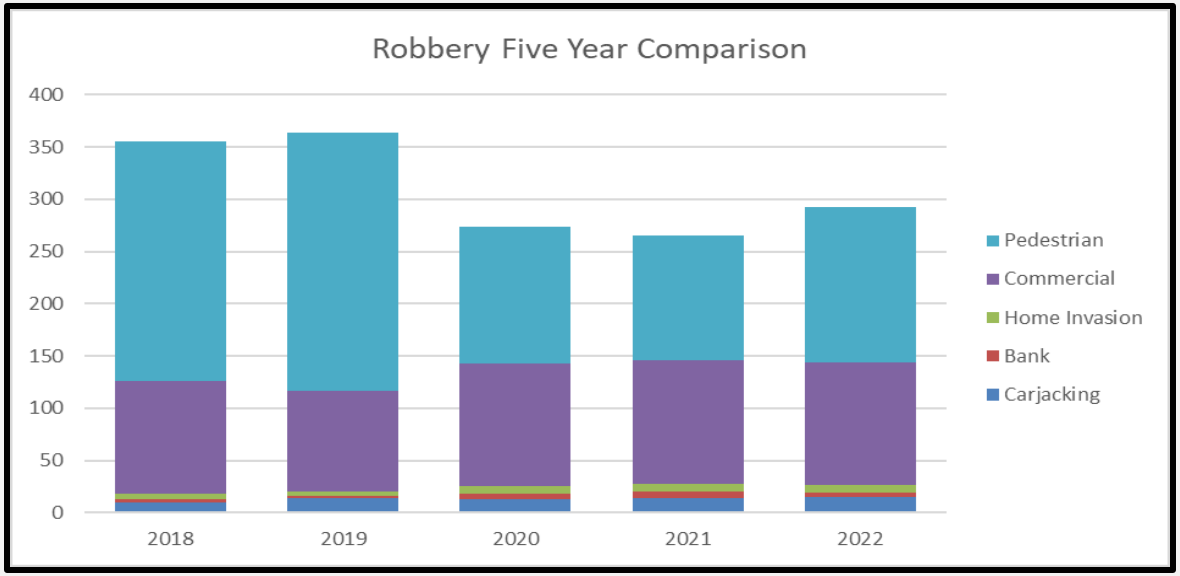


Hate Crimes						
Year	Race/ Ethnicity	Religion	Sexual Orientation	Gender	Disability	Total
2018	11	3	3	1	0	18
2019	5	1	2	0	0	8
2020	7	2	1	2	0	12
2021	29	11	2	0	0	42
2022	24	3	11	0	0	38

CRIME SUMMARY

Hate Crimes

- The **2022** numbers reported reflect a continued heightened awareness.
- Most Hate Crimes reported remain crimes of intimidation (using slurs, leaving graffiti).
- There were no "Profiling by Proxy" calls for service.

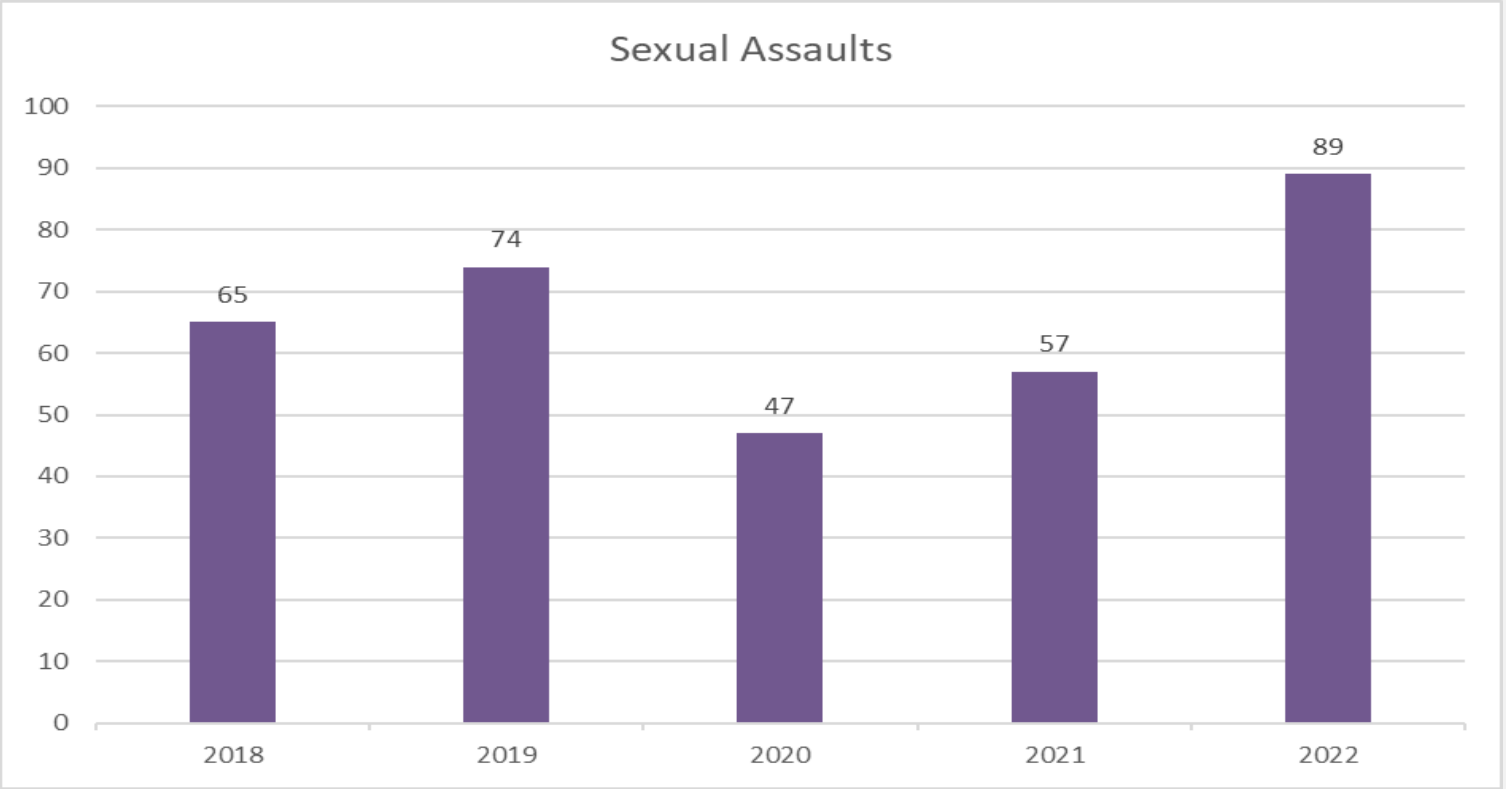


Robbery					
Year	Pedestrian	Commercial	Home Invasion	Bank	Carjacking
2018	**229**	**108**	**5**	**3**	**10**
2019	**247**	**97**	**4**	**2**	**14**
2020	**131**	**117**	**8**	**5**	**13**
2021	**119**	**118**	**8**	**6**	**14**
2022	**148**	**117**	**8**	**4**	**15**

CRIME SUMMARY

Robbery

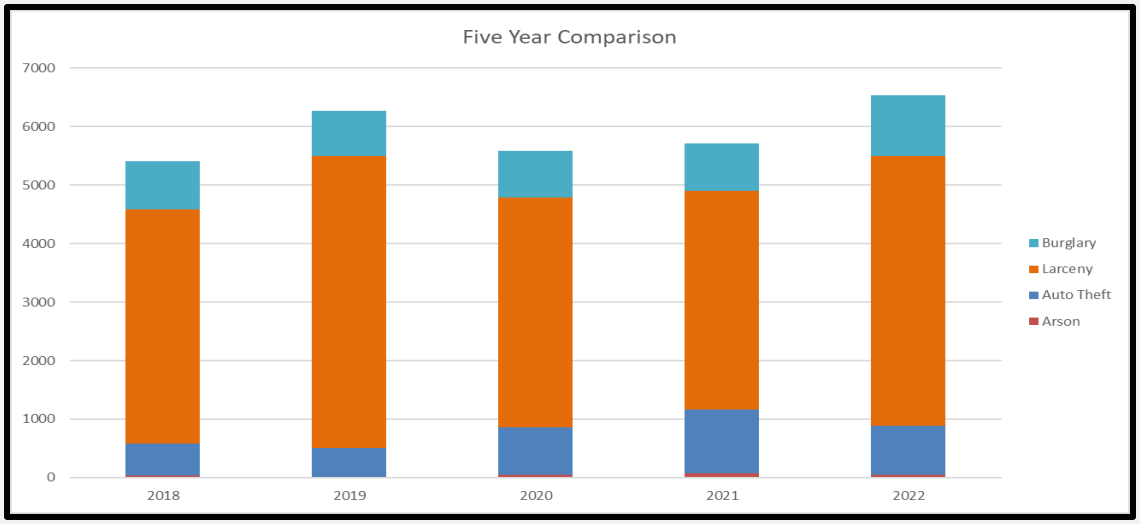
- In **2022** there were only **nineteen** takeover robberies. The remaining **ninety-eight** were Estes robberies.
- Pedestrian robberies increased in **2022**, but are still almost **one hundred** less than reported in **2019**.



The higher number in 2022 continues a trend that began pre-pandemic.

Higher reporting may be due to increased comfort in reporting sexual assaults.

The totals for each year include reports made in that year which may also include events that actually occurred in prior years.



Property Crime					Larcenies of Interest	
Year	Burglary	Larceny	Auto Theft	Arson	Auto Burglary	Catalytic Converter
2018	829	4004	548	31	1739	-
2019	771	4993	492	17	2473	150
2020	797	3933	805	52	1042	523
2021	803	3763	1098	72	1021	477
2022	1036	4611	836	52	1288	995*

CRIME SUMMARY

Property Crime

- There were eight hundred **twenty-six** more property crimes reported in **2022**.
- The only categories that decreased were Auto Theft and Arson.

TRAFFIC COLLISIONS

TRAFFIC COLLISIONS TOTALS

Overview		
	2021	2022
Total Collisions	**789**	**896**
Injury Collisions	**431**	**548**
Fatal Collisions	**7**	**2**
DUI Involved	**39**	**53**

Collision increases:

- Traffic collisions by 13.6%,
- Injury collisions by 27.2%, and
- DUI collisions by 35.9%.

Collision decreases:

- Fatal collisions by 71.4%, and
- Non-injury collisions by 1.4%.

Primary Collision Factors			
2021		2022	
Unsafe Speed	**97**	Failure to yield ROW	**127**
Failure to yield ROW	**92**	Unsafe Speed	**101**
Unsafe turn	**45**	Unsafe turn	**65**
Red light	**40**	Red light	**49**
Failure to yield to pedestrian	**39**	Failure to yield to pedestrian	**47**

Top Intersections			
2021		2022	
Ashby Ave / San Pablo Ave	**9**	Shattuck Ave / Haste St	**12**
MLK Jr Way / Ashby Ave	**6**	Ashby Ave / Shattuck Ave	**12**
Ashby Ave / Shattuck Ave	**5**	Ashby Ave / San Pablo Ave	**11**
Eastshore Hwy / Gilman St	**5**	Ashby Ave / Sacramento St	**11**
Sacramento St / Cedar St	**5**	University Ave / 6th St	**10**

PRIMARY CAUSES AND LOCATIONS

Top primary collision factors have remained consistently the same hazardous driving behaviors.

Ashby Ave has remained a high collision roadway.

Injury Bike Collisions and PCF			
2021		2022	
All	**94**	All	**114**
Bicyclist Not at Fault PCF			
2021	**37**	2022	**60**
Failure to yield ROW	**10**	Unsafe Turn	**16**
Unsafe Speed	**5**	Failure to yield ROW	**13**
Unsafe Turn & Stop Sign	**4**	Stop Sign & Doored	**5**

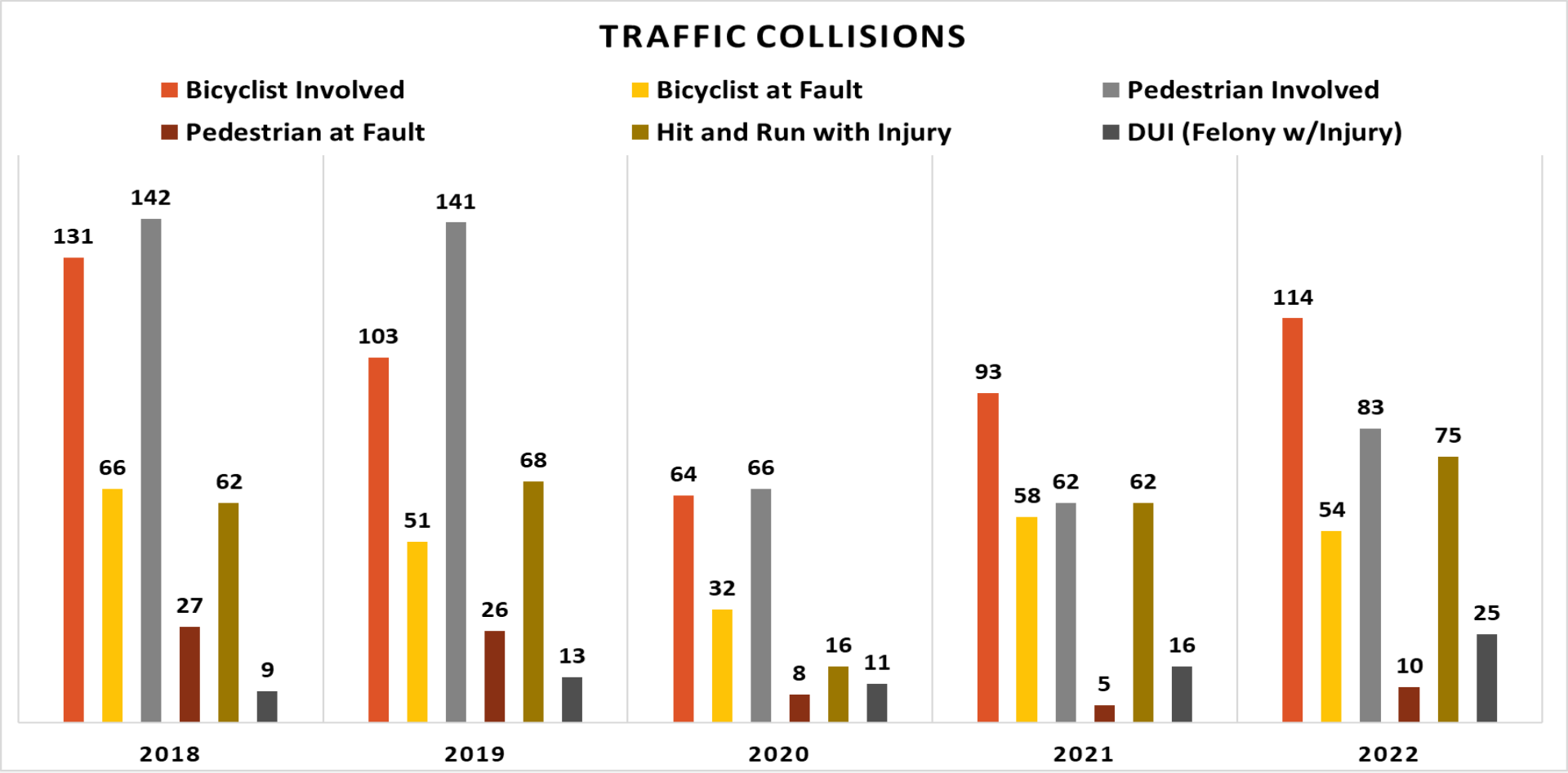
Injury Pedestrian Collisions and PCF (Ped not at fault)			
2021		2022	
All	**62**	All	**83**
Failure to yield to pedestrian	45	Failure to yield to pedestrian	46
Unsafe backing	5	Unsafe Turn	8
Unsafe turn & DUI	4	Unsafe Backing	6

BIKE AND PEDESTRIAN COLLISIONS

Total Bicycle and Pedestrian injury collisions increased

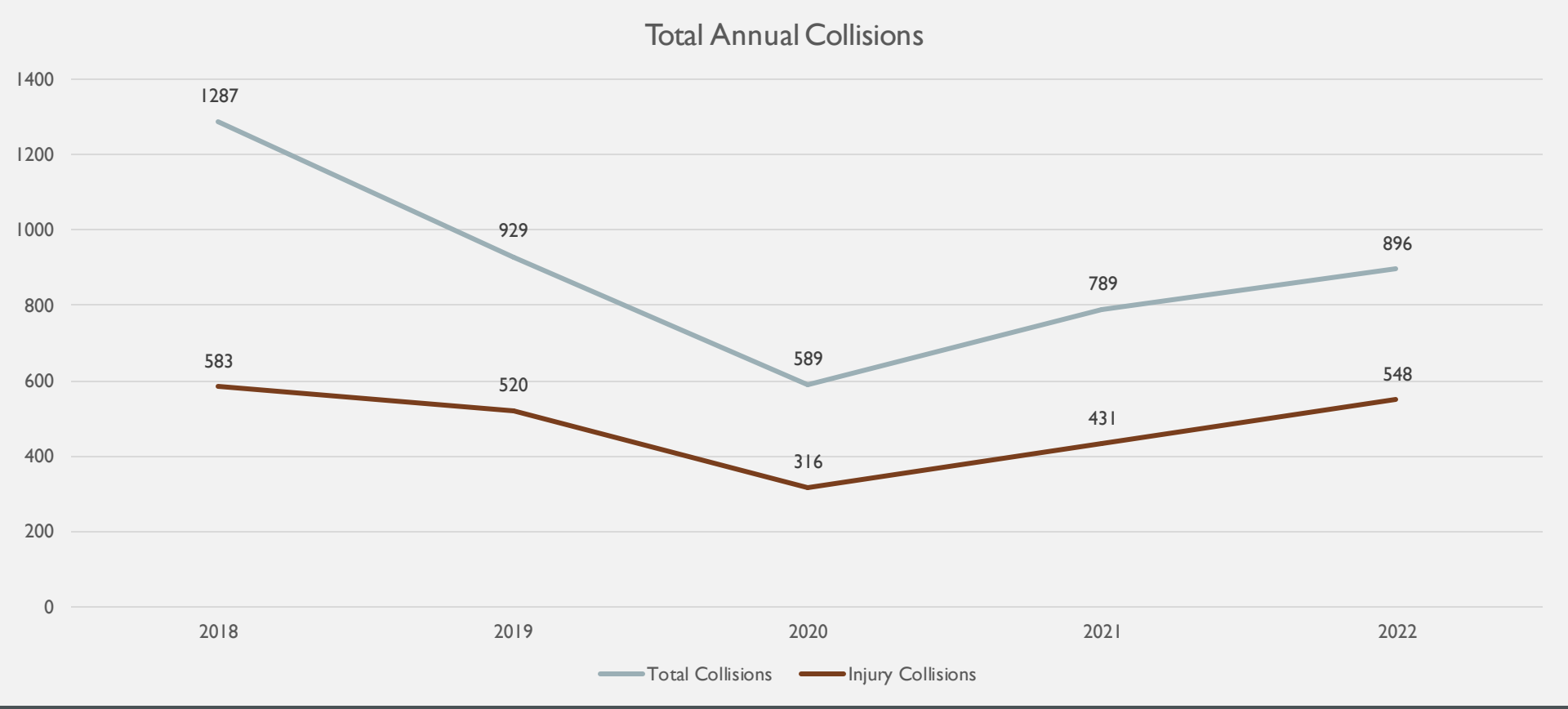
The leading cause of bicycle crashes (not at fault) were unsafe turning

The leading cause of ped crashes (not at fault) was failure to yield at crosswalks



Yearly totals indicate

- Injury collisions were up in all areas
- We use this data to inform our enforcement efforts



While yearly totals indicate our collisions have increased, we have seen a reduction in fatal and non-injury collisions.

- BPD is using this data to create traffic safety strategies and address community concerns.

DEPT. INITIATIVES

1. Office of Traffic Safety (OTS) grants
2. Public education programs
3. Supporting Vision Zero Goals

Traffic Bureau Programs

- BPD is using collision data to create traffic safety strategies and address community concerns.

STOP DATA

THREE-PRONGED APPROACH

1

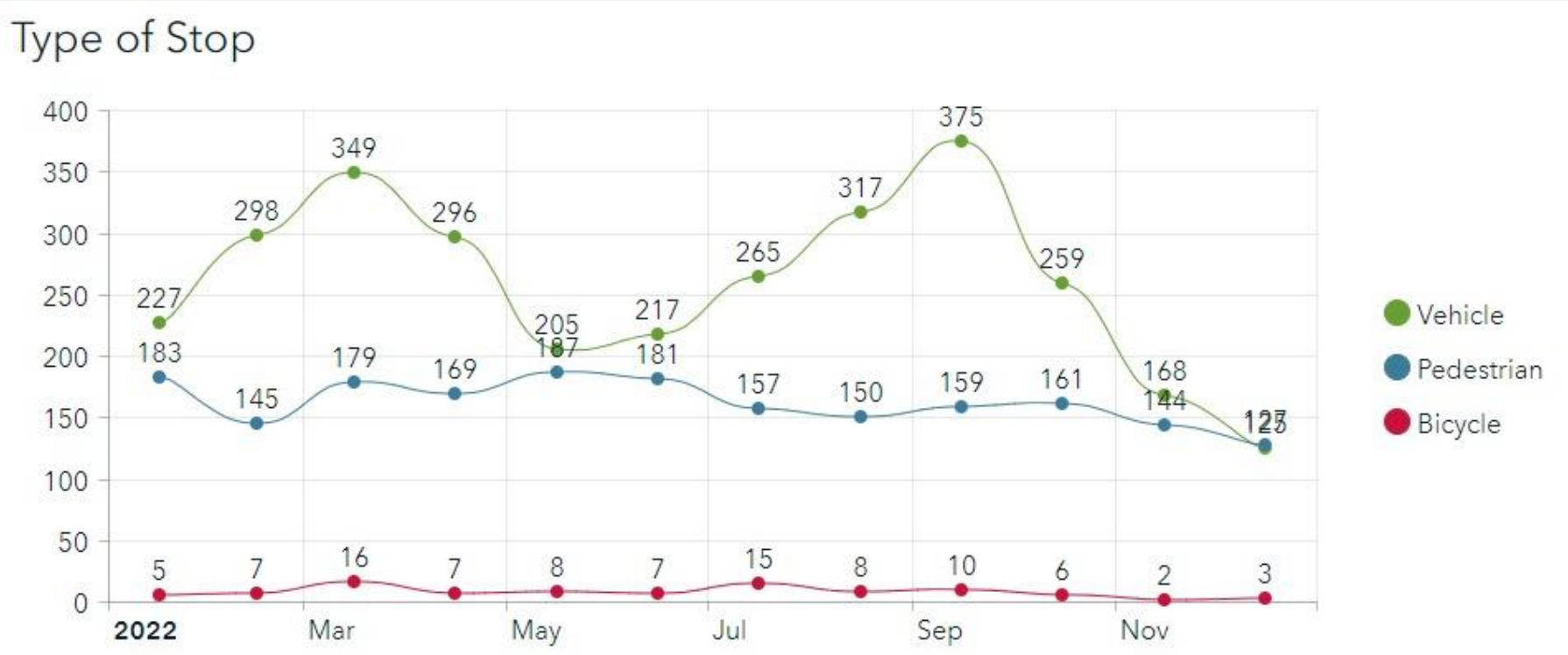
Be data-driven and focused on violations associated with the collisions in our city.

2

Respond to and address traffic violations that are brought to us by the community.

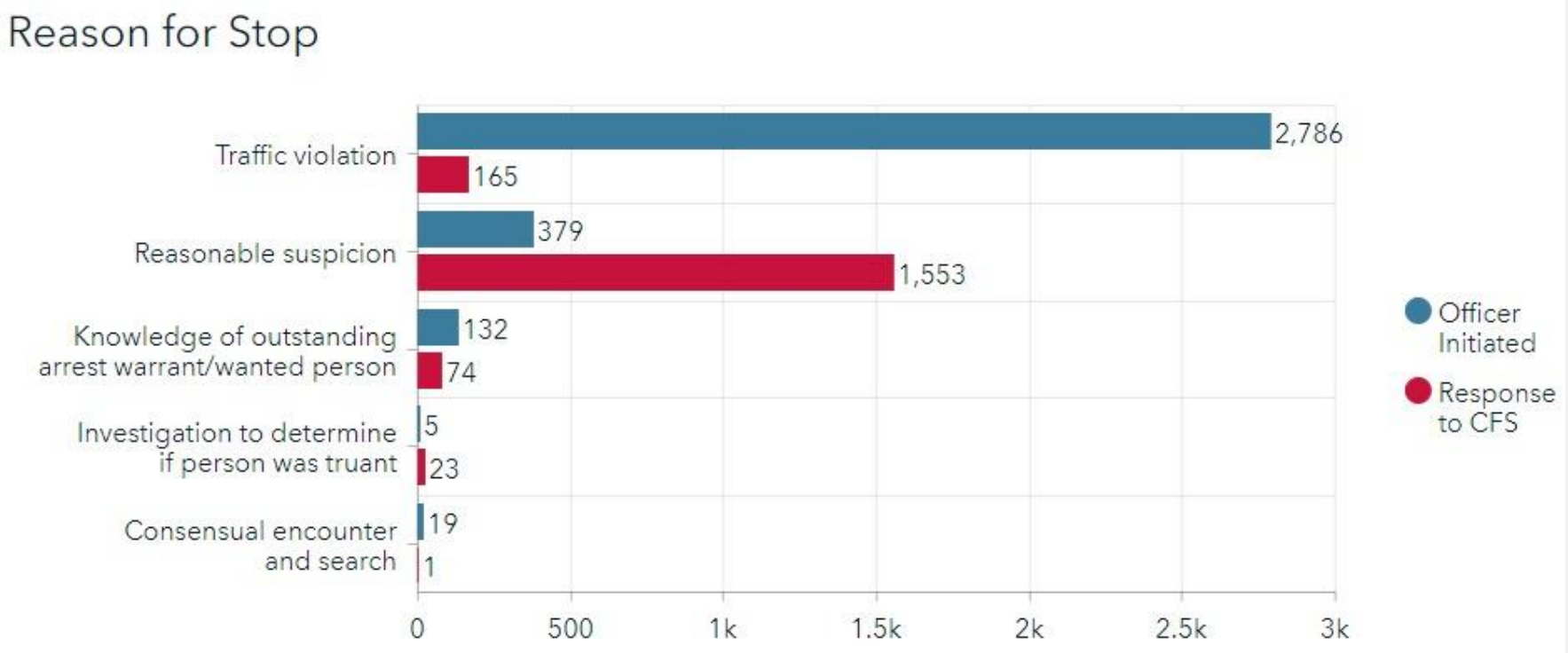
3

Focus on observed violations that relate to vehicle, bicycle, and pedestrian safety



Stop volume continues to be low

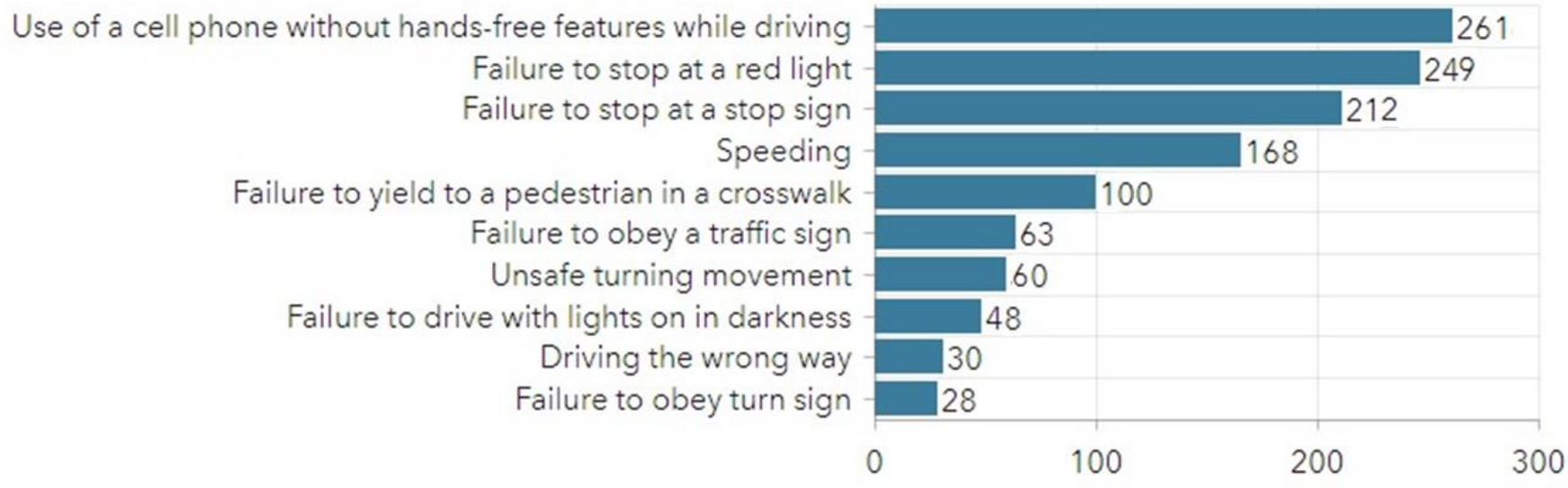
- In 2022 BPD averaged 258 vehicle stops, 162 pedestrian stops, and 9 bicycle stops a month.



Traffic violations drive stops

- 64.67% Officer-initiated stops were for traffic violations
- 80% reasonable suspicion stops were due to a call.

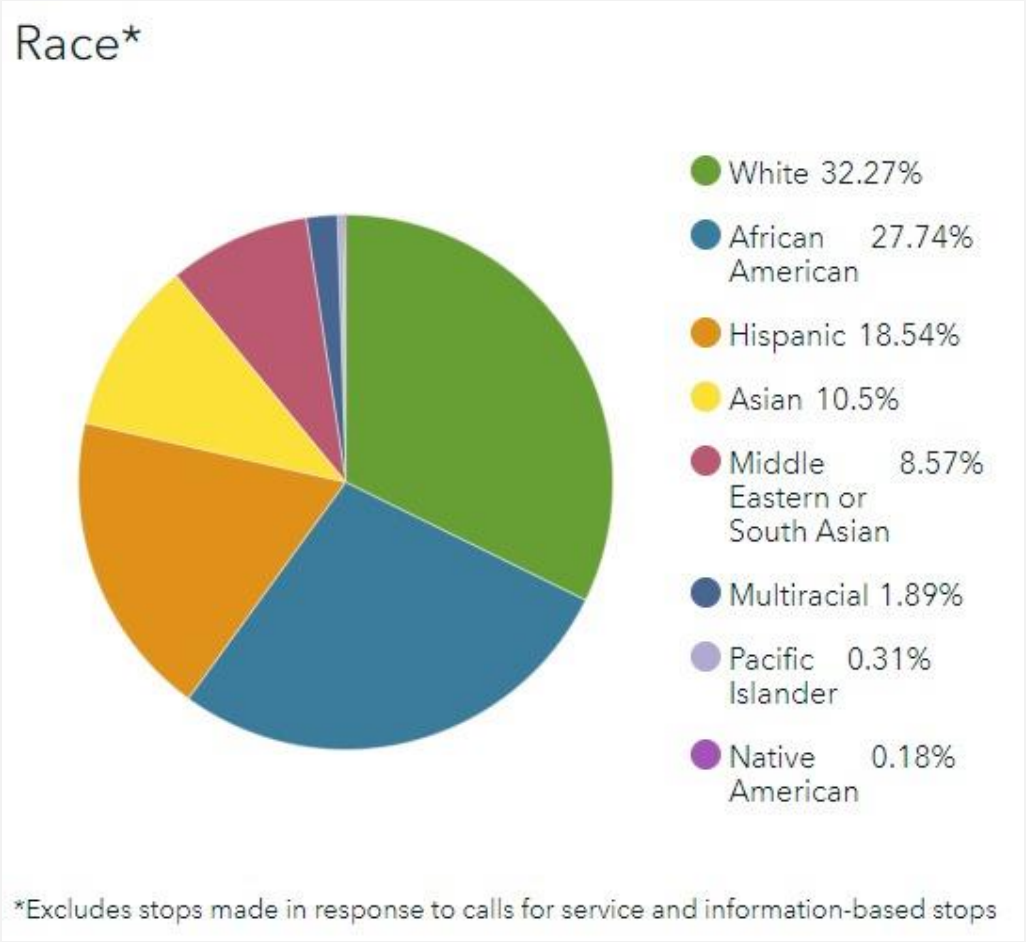
Most frequent moving violations*



*Excludes stops made in response to calls for service and information-based stops

Traffic stops focus on dangerous driving

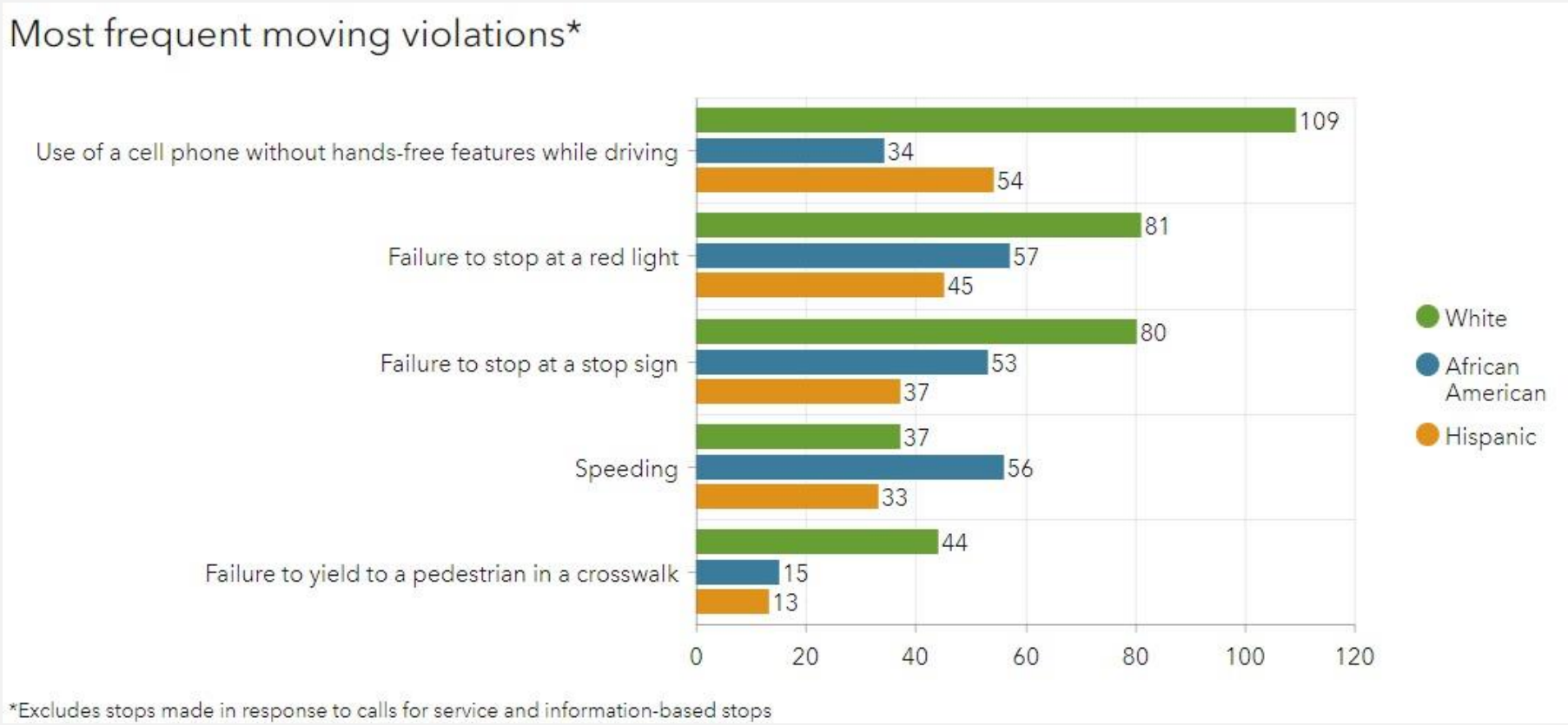
- 20% relate to stopping at controlled intersections.
- 76% were for moving violations.



OFFICER INITIATED STOP DATA

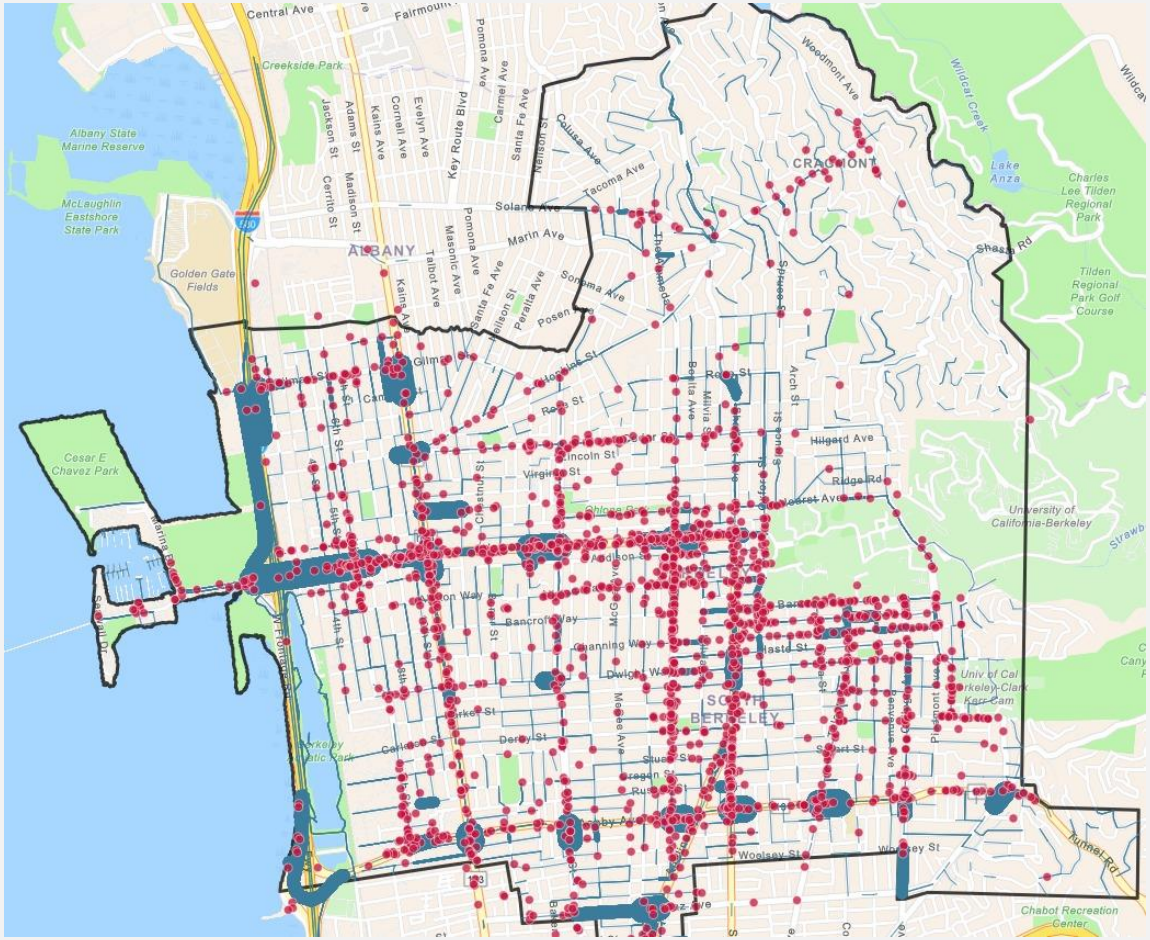
Evaluating Stop Data Demographics

- BPD monitors stop data to ensure enforcement activities are driven by our three-prong approach.
- Excluding those stops, **51%** of those stopped were not Berkeley residents.



Stops focus on dangerous driving

- Of stops excluding stops made in response to calls for service or information-based stops, **71% (1,581 of 2,228)** were moving violations.
- Those moving violations map to top primary collision factors and other serous traffic safety violations.



STOP DATA

Stops focus on dangerous driving

- Red dots represent traffic stops for moving violations.
- Blue lines get thicker for road segments with high volumes of traffic-related calls for service.
- Enforcement is focused around the most dangerous roads and intersections.

STOP DATA

Overall Search Rate	**20%**
Overall Yield Rate	**51%**
Weapons Recovered	**92**
Firearms Recovered	**16**

Search Rate (African American)	**28%**	Yield Rate (African American)	**51%**
Search Rate (White)	**20%**	Yield Rate (White)	**50%**
Search Rate (Hispanic)	**17%**	Yield Rate (Hispanic)	**59%**

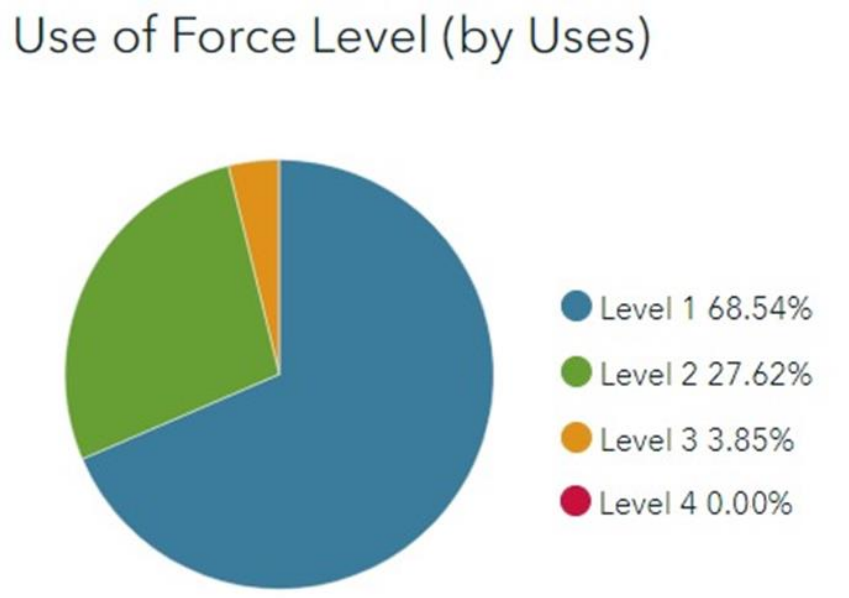
Yield rates signal race-neutral factors drive decision to search

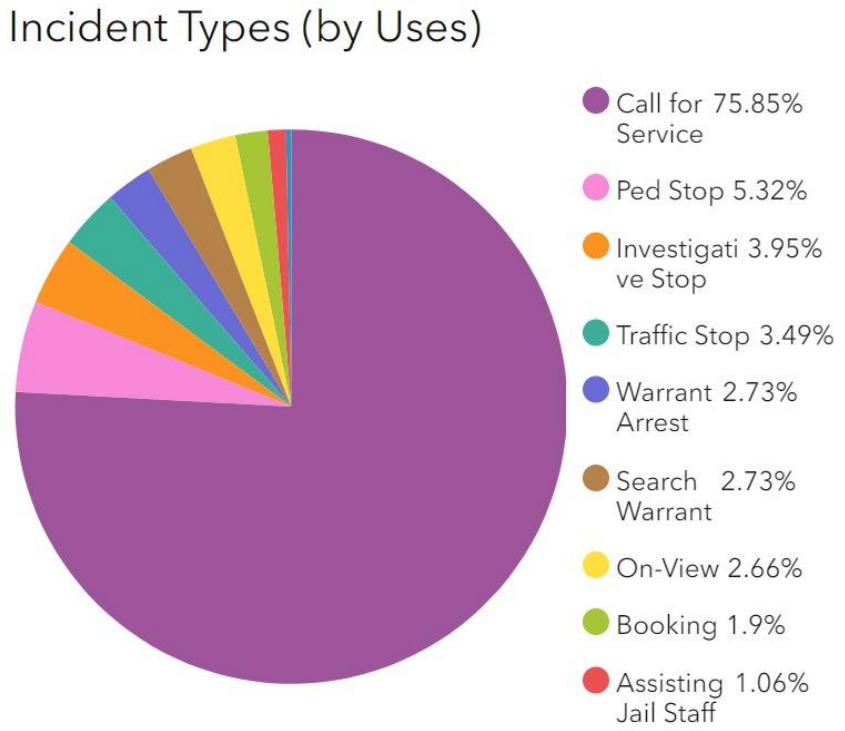
- Yield rate analysis tests whether an officer's decision to search is subject to a lower threshold of suspicion for African American and Hispanic people as compared to for White people.
- The method assumes that race-neutral indicators observable by an officer will accurately predict the probability that a search will turn up contraband.

USE OF FORCE DATA

REPORTING STANDARDS

Level 1	Level 2	Level 3	Level 4
• Grab, control hold, leverage, body weight.	• Drawing or pointing a firearm to compel action, more than momentary discomfort.	• Level 2 without BWC, use of a weapon, injury, complaint of pain.	• Use of firearm, in custody death

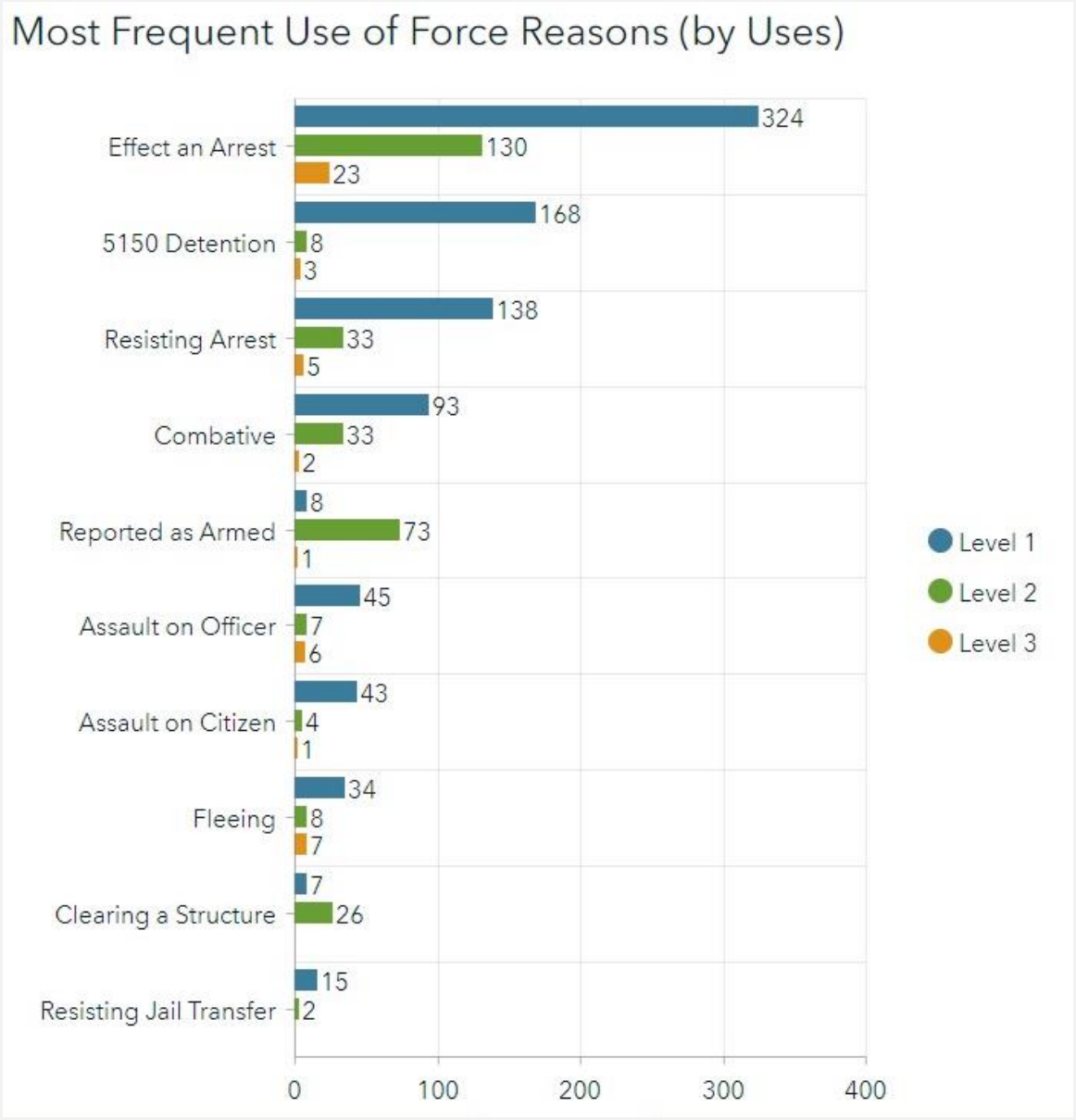




USE OF FORCE

Type of force used

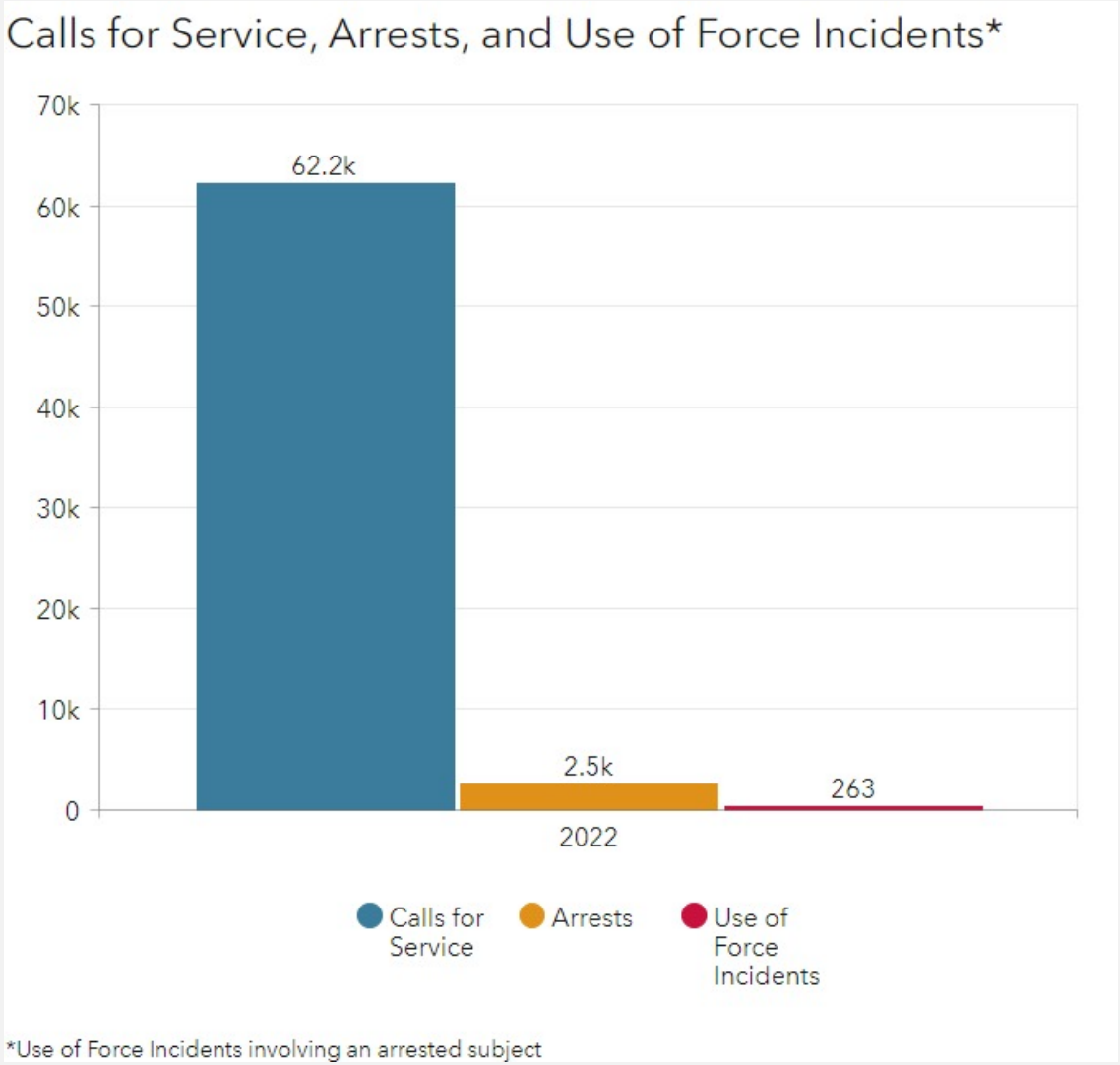
- 96% of BPD's use of force incidents were Level One and Two.
- Calls for service account for 2/3's of this year's force incidents.



USE OF FORCE

Why was force used?

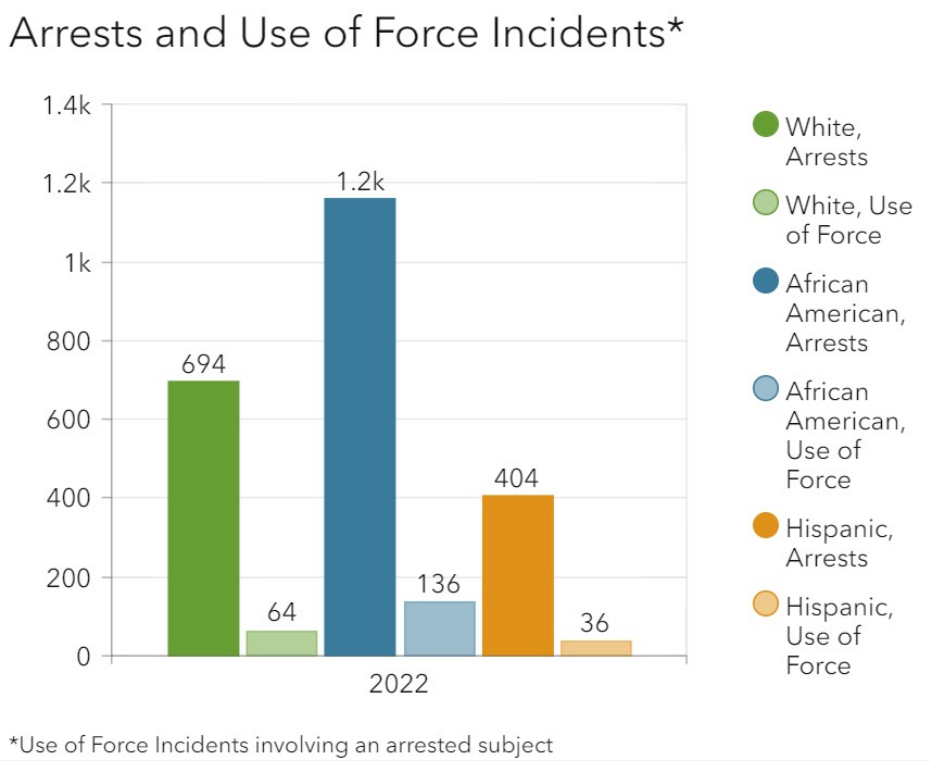
- The highest category was "Effect an Arrest" which accounted for 37% of our total uses of force.

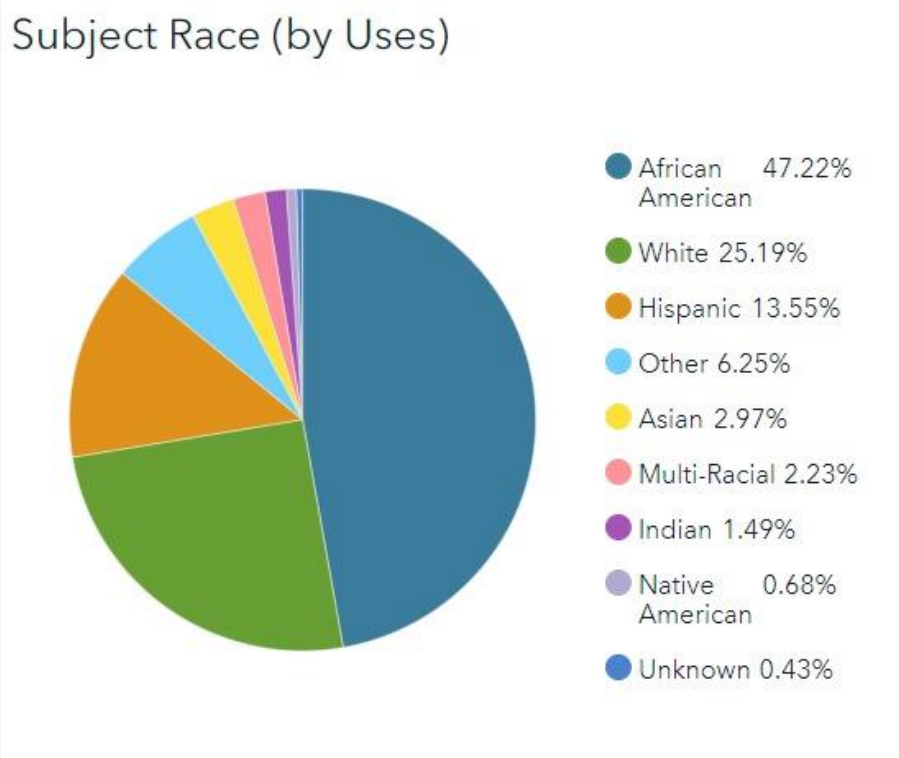


USE OF FORCE

Use of force incidents continue to be rare

- A very small number of our contacts result in an arrest or use of force.





Demographic breakdown of use of force incidents

- Comparing force incidents and arrest data.

Complaints

- **5** total complaints
  - Involving **19** uses of force

Evaluation

- **2** of the **5** complaints are currently being evaluated

Findings

- **3** of the **5** complaints have been fully reviewed
  - **2** of the **3** completed reviews were also assessed by the DPA and PAB
  - **0** of the **3** completed reviews resulted in findings of improper use of force

BPD received no complaints regarding use of force that were sustained

- Each use of force was reviewed and evaluated by a Sergeant, Lieutenant, and Captain.
- If a complaint was received a second review and evaluation was done through Internal Affairs, an internal Board of Review and the Chief.

REINFORCING BEST PRACTICES

RECOVERY OFFICER

- Closely observe condition of subject.
- Request Berkeley Fire Paramedics respond.
- Coach involved officers in transitioning from custody to care.

DUTY TO INTERCEDE

- BPD has had a "Duty to Intercede" policy for over a decade.
- Fundamental training element in our use of force training scenarios.

COUNCIL REFERRAL ITEMS & DEPARTMENT INITIATIVES

CITY AUDITOR REPORTS

1

911 Dispatchers: Understaffing Leads to Excessive Overtime and Low Morale

Nearing Completion

2

Data Analysis of Berkeley's Police Response

Nearing Completion

3

Berkeley Police: Improvements Needed to **Manage Overtime** and Security Work for Outside Entities

Ongoing

FAIR AND IMPARTIAL POLICING

Special Order

Procedural Justice Reforms & Early Warning System (EWS)

Staffing / Capacity Study of police calls and responses

SWORN STAFFING ANALYSIS

Support recommendations from the **Re-Imagining Public Safety** process.

Fair and Impartial Policing recommendation re: Staffing and Capacity study

Inform decision-making as we rebound from a low point expected in the next year to 18 months.

DEPARTMENT PRIORITIES

1

Personnel: Recruitment and Retention

2

Proactive public safety and problem solving

3

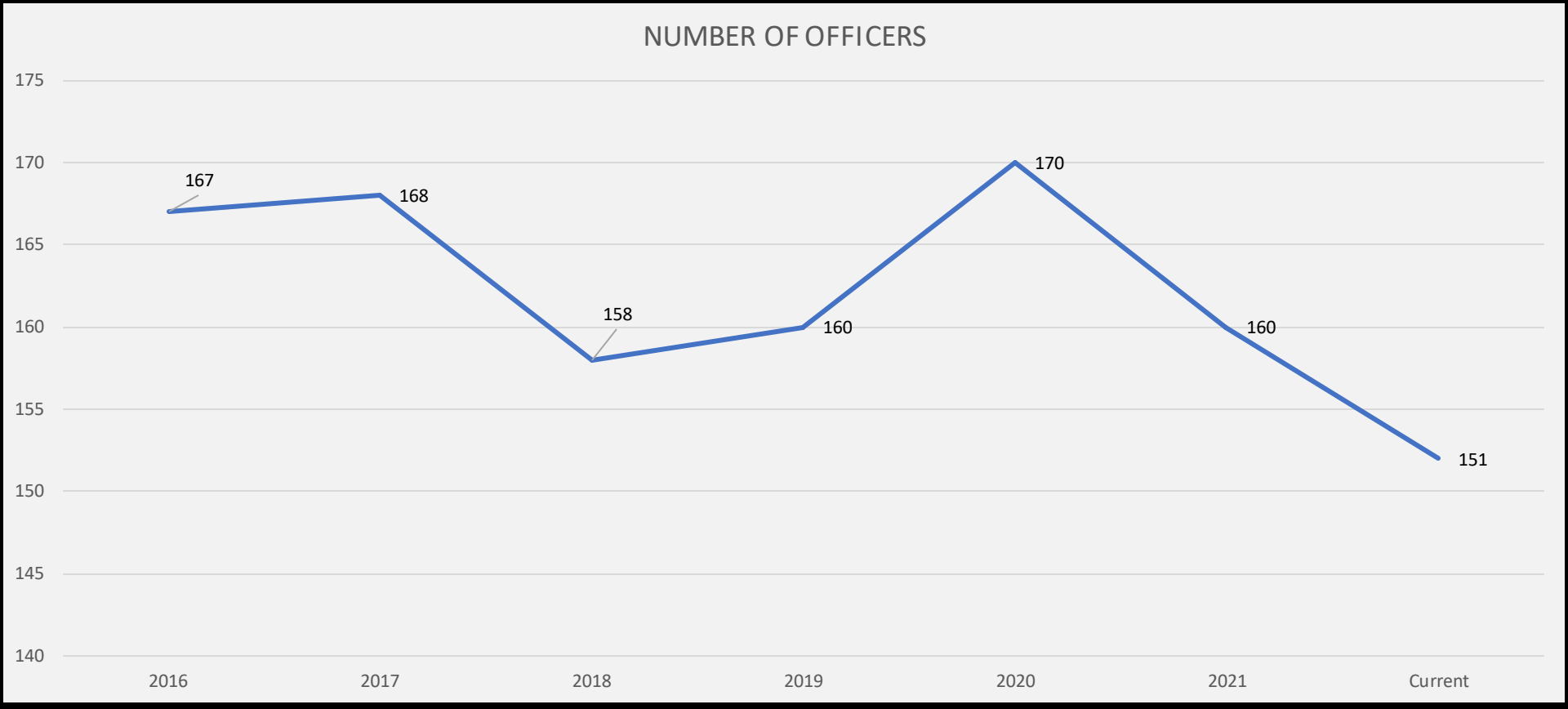
Communication: Accountability and transparency through internal and external communication

DEPARTMENT PERSONNEL

Current Staffing Levels

Challenges

Recruitment Efforts



Current staffing levels are at historic lows for sworn positions and dispatchers

- BPD is authorized 181 sworn officers and, currently staffed at 151
- BPD is authorized 36 dispatch positions, currently staffed with 20 dispatchers and 4 dispatch supervisors.
- Overall departmental vacancy rate is 25%

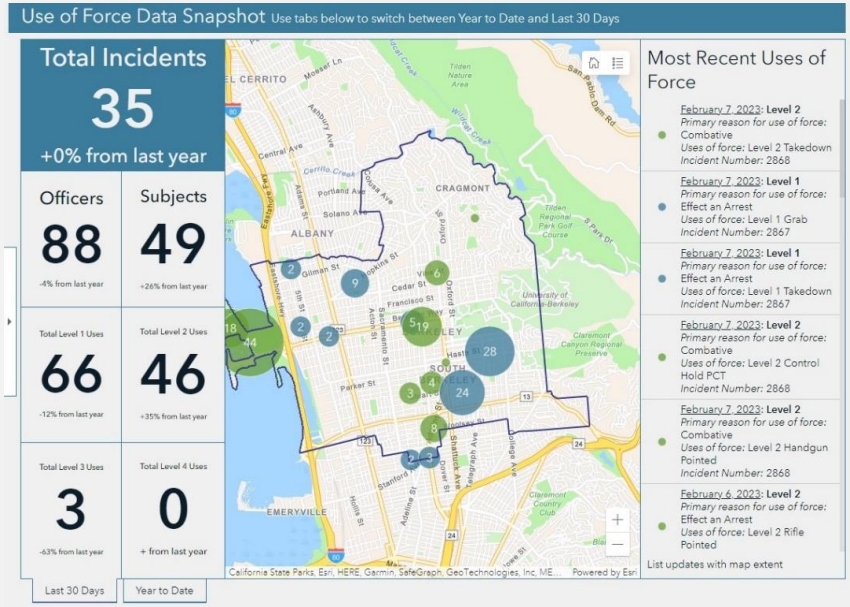
RECRUITMENT CHALLENGES

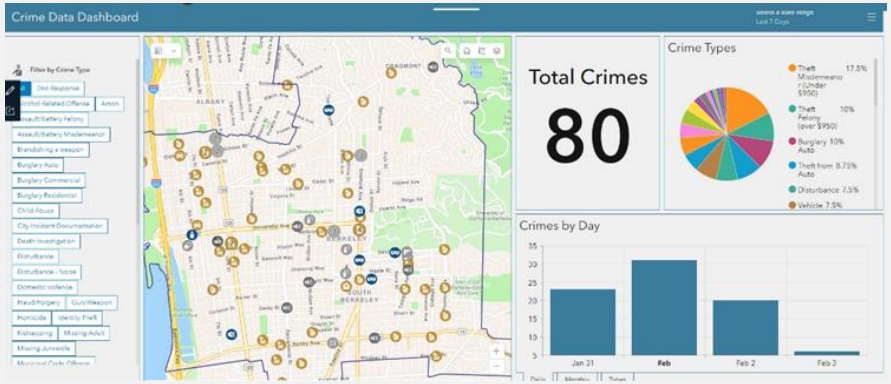
- The hiring process takes time
- Candidate pools are shrinking
- Competition high with other agencies

RECRUITMENT EFFORTS

Recruitment efforts are going strong

- Locally focused
- Job postings, on-campus job fairs, special events, community presentations, referrals and social media.





DEPT. INITIATIVES

Strategic Analysis:

Accomplishments

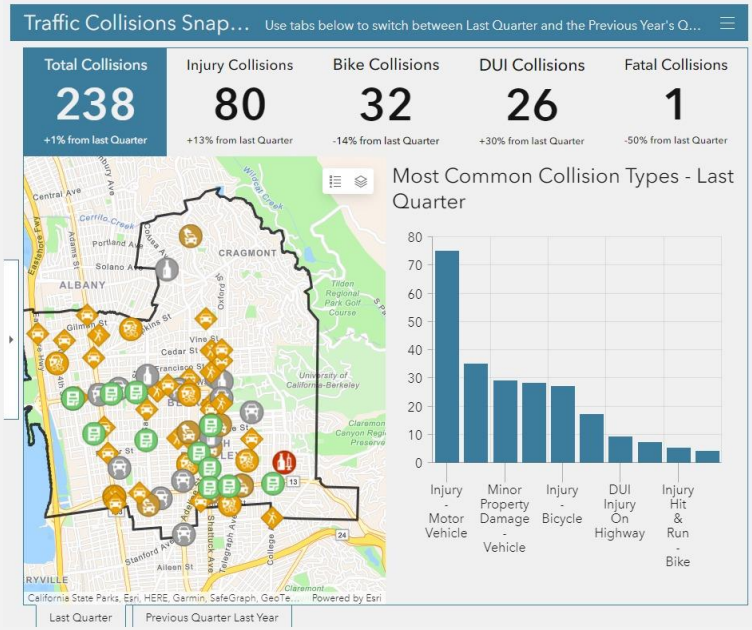
- Formed Strategic Analyst Team
- Launched Transparency Hub
- Internal data tools and problem-solving workflows

DEPT. INITIATIVES

Strategic Analysis:

Accomplishments

- Opened process for community members to request Crime Prevention through Environmental Design (CPTED) consulting from our CPTED certified officers.



DEPT. INITIATIVES

Strategic Analysis:

Next Steps

- University partnerships
- Traffic page on the Transparency Hub
- Operationalize data into problem-oriented projects

THANK YOU. QUESTIONS?

Department for Transport

Road Safety Web Publication No. 16

Relationship between Speed and Risk of Fatal Injury: Pedestrians and Car Occupants

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September 2010

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CONTENTS

EXECUTIVE SUMMARY

This study explores the relationship between speed and the risk of fatal injury for three different types of traffic accident:

- pedestrians struck by the front of cars;
- car drivers following frontal impacts; and
- car drivers following side impacts.

The risk of fatality with impact speed (for pedestrians) and change of velocity (for seat-belted car drivers) has been calculated using a logistic regression method, and three current sources of accident data in the UK:

- the On the Spot (OTS) project;
- police fatal files; and
- the Co-operative Crash Injury Study (CCIS).

This same method of logistic regression has been applied to two other important sources of pedestrian accident data: data collected by Ashton and Mackay in Birmingham in the 1970s, and data from the German In-Depth Accident Study (GIDAS) used by Rosén and Sander in their 2009 paper. Using the same method on these different datasets means that the results can be directly compared. The risk of fatality was then plotted in the form of risk curves for each dataset.

Comparison of the pedestrian risk curves from the different datasets shows that the risk of pedestrian fatality is generally higher for the dataset from the 1970s, indicating that the probability of pedestrians being killed when hit by the front of a car has reduced over the last 30 years. In all of the pedestrian datasets, the risk of fatality increases slowly until impact speeds of around 30 mph. Above this speed, risk increases rapidly – the increase is between 3.5 and 5.5 times from 30 mph to 40 mph. Although the risk of pedestrians being killed at 30mph is relatively low, approximately half of pedestrian fatalities occur at this impact speed or below.

Comparing the risk of fatality for a seat-belted driver in a frontal impact with a side impact shows that the risk of fatality is much higher in a side impact than in a frontal impact with the same change of velocity.

1 INTRODUCTION

There are many variables in a road traffic accident that will affect the injury severity of the people involved. These include factors related to the casualty (age, gender, biomechanical tolerance, seat-belt wearing, etc.), factors related to the vehicle (size, shape, impact speed, effectiveness of absorbing impact energy, etc.), and factors related to the wider environment (characteristics of the object hit, effectiveness of the medical treatment, etc.). All these variables have an important relationship to the likely injury severity of the casualty.

One of the most widely studied variables is speed. For pedestrians, this is typically measured in terms of the speed of the vehicle at the point of impact with the pedestrian. For vehicle-on-vehicle impacts, the change in velocity of the vehicles involved is generally accepted as the measure of speed that is most closely linked to injury severity. The purpose of this report is to investigate the relationship between speed and the risk of fatal injury, for both pedestrians and car occupants. This investigation uses accident data currently being collected in the UK, and compares it with results from other studies around the world.

There is a particular focus on the relationship between impact speed and the risk of fatality for pedestrians in impacts with cars. Pedestrians are a particularly vulnerable road-user group, with small changes in impact speed potentially having a large effect on the risk of fatal injury. This study uses accident data collected in the UK to calculate the relationship between impact speed and the risk of fatal injury for pedestrians, and the associated confidence in this result. Using the same method as other studies, results from other studies are compared to determine how much this relationship changes in different countries and over time.

2 PEDESTRIAN INJURY RISK CURVES

A review of the literature on the relationship between impact speed and pedestrian injury found that two main sources of accident data have been used to calculate this relationship. These are data collected by Ashton and Mackay in Birmingham in the 1970s, and data collected by the German In-Depth Accident Study (GIDAS). In addition to these, recent data from the UK have been used for the pedestrian injury risk curves in this study (police fatal files and the On the Spot (OTS) project). In this section, the same method will be used on each of these datasets to calculate the relationship between impact speed and the risk of fatal injury for pedestrians. All of these datasets contain pedestrians hit by the front of cars only.

The method used to calculate the pedestrian injury risk curves is described, and then each of the data sources is investigated in turn. This begins with a review of the relevant literature, which gives details of the sample used, and the methods used to calculate the relationship between impact speed and injury severity. Following this, the same method of logistic regression is used for all three data sources in order to compare the relationship between impact speed and the risk of fatal injury. Using the same method for all three data sets enables the results to be compared directly – the differences will be due to differences in the sample alone.

2.1 Methodology overview

There are two main stages to calculating pedestrian injury risk curves. The first involves weighting the data to match national statistics, and the second is the calculation of the injury risk curves themselves and their associated confidence using logistic regression. These curves have been calculated for three sources: the Ashton and Mackay data from the 1970s; the GIDAS data from 1999–2007; and the OTS and police fatal file data from 2000–09.

It should be noted that logistic regression is not the only method which can be used for this type of analysis. Appendix 2 outlines an alternative Bayesian method, and compares it with logistic regression. The two methods give very similar results.

2.1.1 Weighting data

The data collected in the accident studies have been weighted to the total number of pedestrian casualties that occur nationally. This is to ensure that the results are representative of the national accident population in terms of severity level. In-depth accident studies tend to record a larger proportion of fatal and serious casualties than in national statistics. This could be because the sample is purposefully biased (fatalities and serious casualties may be more interesting from an injury prevention point of view), or because of the practicalities of collecting in-depth accident data

(e.g. in a low-speed, low-severity collision, there will be little evidence available with which to calculate an impact speed).

The weighting procedure weights the number of fatal, serious and slightly injured casualties in the dataset so that they represent the same proportion of fatal, serious and slight casualties seen in the national data.

Table 2.1 gives details of the sample size and weighting performed on the pedestrian cases in the Ashton and Mackay data based on the information available in Ashton (1980). The Ashton and Mackay dataset included pedestrians in impacts with the front of cars. Ashton used the number of pedestrian casualties that occurred in 1976 to weight the pedestrian dataset in that paper – regardless of the type of vehicle hitting the pedestrian, or the side of the vehicle which hit them. The weighting applied to the Ashton and Mackay data in this report will be the same as used by Ashton, so that the results can be directly compared with other studies that used the Ashton and Mackay data.

Table 2.1: Sample size and weighting for Ashton and Mackay data

Pedestrian casualties in Great Britain, 1976				Pedestrian casualties in sample	Weighting factors
Age	Injury severity	Number	Proportion (%)		
0–14	Fatal	405	1.4	12	33.8
	Serious	7,461	25.8	72	103.6
	Slight	21,072	72.8	71	296.8
15–59	Fatal	720	2.9	35	20.6
	Serious	6,276	25.2	55	114.1
	Slight	17,873	71.9	31	576.5
60+1	Fatal	1,208	9.4	34	35.5
	Serious	4,431	34.3	38	116.6
	Slight	7,272	56.3	10	727.2
All ages	Fatal	2,333	3.5	81	28.8
	Serious	18,168	27.2	165	110.1
	Slight	46,217	69.3	112	412.7

Table 2.2 gives details of the sample size and weighting performed on the pedestrian cases in the OTS and police fatal file sample. The weighting was particularly important for this sample because of the large proportion of fatalities (many of these cases came from the police fatal files, which provided fatally injured pedestrians only). As the sample only included pedestrians hit by the front of cars, it was weighted using the number of pedestrians reported to have been hit by the front of cars nationally.

Table 2.2: Sample size and weighting for the OTS and police fatal file data				
Pedestrian casualties with the front of cars in Great Britain, 2005–07 mean			Pedestrian casualties in sample	Weighting factors
Injury severity	Number	Proportion (%)		
Fatal	347	2.4	66	5.26
Serious	3,171	21.7	74	42.9
Slight	11,116	76.0	57	195.0

It should be noted that there are some slight and serious accidents which are not reported to the police and, therefore, are not present in the national statistics (Department for Transport, 2009). This means that once the results are weighted, they are likely to give an overestimate of the risk of fatality.

Details of the weighting procedure for the GIDAS sample used in Rosén and Sander (2009) are given in that paper. The weighting procedure used was the same as that used for the other samples. The number of slight, serious and fatal pedestrian casualties in the sample were weighted to the number of slight, serious and fatal casualties in Germany from 2003 to 2007.

2.1.2 Logistic regression

The speed-injury risk curves for fatal injuries were drawn using logistic regression. This process predicts how a variable with only two possible values (in this case 'fatal' or 'not fatal') is dependent on a continuous variable (in this case 'impact speed'; Pallant, 2005). Confidence intervals were also drawn, which show the area within which the true speed–injury curve is likely to lie. In this study, the confidence intervals given are at 95%, i.e. they show the range of values where there is a 95% chance of the true value lying.

The logistic regression and calculation of confidence intervals were performed using the statistical programming package 'R'. Example code and output from this process can be seen in Appendix 1.

2.2 Results

2.2.1 Ashton and Mackay data

2.2.1.1 Literature

In the 1970s, Ashton and Mackay led an in-depth accident study that collected information on pedestrian accidents. This was an on-the-scene investigation by a team based at the Accident Research Unit at the University of Birmingham (Ashton and Mackay, 1979). This data were weighted to the number of pedestrian casualties occurring nationally (Ashton, 1980). The dataset included pedestrians struck by the

front of cars or car derivatives, and was biased towards more severe accidents. The injury severity of the pedestrians was recorded using the police definitions of 'fatal', 'serious' and 'slight':

- Fatal – death within 30 days of the accident.
- Serious – includes fractures, concussion, internal injury, crushing, severe cuts and lacerations, severe shock requiring medical treatment, or any casualty who was detained as an in-patient in hospital.
- Slight – minor sprains, bruises or lacerations which are not serious.

Ashton and Mackay used this pedestrian dataset to estimate the impact speed distribution of pedestrian accidents in Great Britain. However, they did not use these data to calculate speed–injury risk curves for pedestrian impacts, although several authors have since.

Pasanen (1992) calculated a relationship between **driving speed** and the risk of pedestrian fatality. As part of this calculation, Pasanen calculated the relationship between impact speed and the risk of pedestrian fatality using the data from Ashton (1980). Pasanen applied a non-linear regression model based on the least squared method, and calculated the following relationship between impact speed in metres per second (v) and the probability of fatality (P):

$$P = \frac{1.027}{1 + 37e^{-0.017v^2}} - 0.027 \qquad (2.1)$$

However, Pasanen did not weight the data collected by Ashton and Mackay to represent the national proportion of fatal, serious and slight casualties. Because the Ashton and Mackay data contained a higher proportion of fatalities than was recorded nationally, Pasenen's results are an overestimate of the risk of pedestrian fatality.

The work of Ashton and Mackay, and Pasanen, has been widely quoted in the literature when the relationship between speed and pedestrian injury is discussed. These include studies which are often referred to as giving the risk of pedestrian injury with speed, but which in fact refer to the work by Ashton and Mackay or Pasanen, such as Pasanen and Salmivaara (1993), European Transport Safety Council (1995), World Health Organization (2004), and European Transport Safety Council (2010).

Davis (2001) also used the data collected by Ashton and Mackay to calculate the relationship between the risk of pedestrian fatality and impact speed. Davis used an ordered, discrete outcome model to calculate the relationship between impact speed and risk of pedestrian fatality, and did weight the data to the national proportion of fatal, serious and slight casualties. Davis performed these calculations separately for the three age groups included in the Ashton data: children (aged 0–14 years), adults

(aged 15–59 years), and the elderly (60+ years). Davis found the following relationships between the probability of fatality (P) and impact speed (v) in kilometres per hour:

$$P_{children} = 1 - \frac{e^{8.85-0.12v}}{1+e^{8.85-0.12v}} \tag{2.2}$$

$$P_{adults} = 1 - \frac{e^{8.87-0.13v}}{1+e^{8.87-0.13v}} \tag{2.3}$$

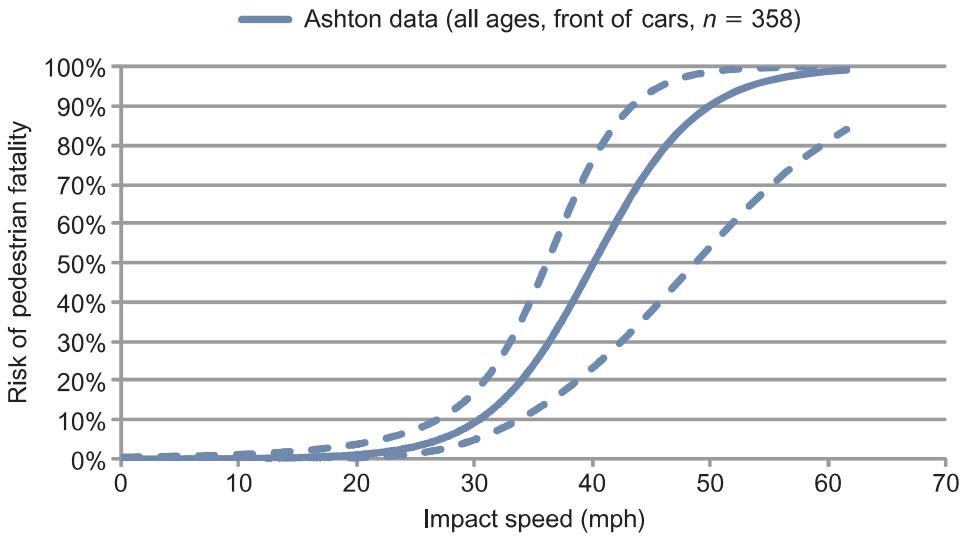
$$P_{elderly} = 1 - \frac{e^{9.73-0.20v}}{1+e^{9.73-0.20v}} \tag{2.4}$$

The studies by Pasanen and Davis used the tables of data published in Ashton (1980). These tables gave the number of pedestrians injured by injury severity, age group and impact speed. However, the impact speed was given in groups of 10 km/h. This places a limitation on the accuracy of any risk curves based on these data. However, a good approximation used by Davis, and which is also used in this study, is to assume that the impact speeds are uniformly distributed within each impact speed group. For example, if there are 10 pedestrians with an impact speed in the range of 31–40 km/h, it is assumed that the impact speeds are 31, 32, 33, 34, 35, 36, 37, 38, 39 and 40 km/h. For the pedestrians in the uppermost speed group (71 km/h and over), it was assumed that the speeds were uniformly distributed between 71 km/h and 100 km/h – this is the same assumption used by Davis (Rosén *et al.*, 2010).

2.2.1.2 Results of logistic regression

In this report logistic regression has been used on the pedestrian dataset in Ashton (1980), weighted using the weighting factors shown in Table 2.1. The result of using this method on the total Ashton and Mackay pedestrian sample is shown in Figure 2.1. This figure shows that the estimated risk of a pedestrian being killed is approximately 9% if they are hit at a speed of 30 mph. The risk at an impact speed of 40 mph is much higher, at approximately 50%. This figure also shows that the confidence intervals (the dashed lines in the figure) get much wider as the impact speed increases. This is because there are fewer pedestrians in the sample at higher speeds, which reduces the precision of the estimated risk at these speeds.

Figure 2.1: Risk of pedestrian fatality calculated using logistic regression from Ashton and Mackay data



Figures 2.3–2.4 show the estimated relationship between impact speed and the risk of fatality for children (1–14 years), adults (15–59 years) and elderly pedestrians (60+ years), respectively. These are the age groups used in Ashton (1980), and are also the groups used by Davis (2001) when calculating the relationship between impact speed and the risk of fatality. Each of these graphs show the risk of fatal injury, the confidence intervals calculated for these data using the logistic regression method (the blue lines), and also the curves calculated by Davis (the red lines).

Figure 2.2: Risk of child pedestrian fatality calculated using logistic regression from Ashton and Mackay data compared with the Davis function

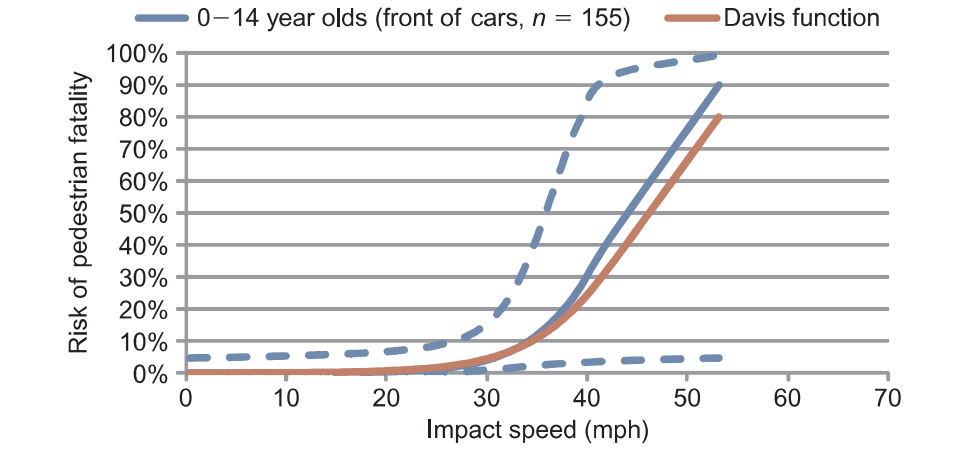


Figure 2.3: Risk of adult pedestrian fatality calculated using logistic regression from Ashton and Mackay data compared with the Davis function

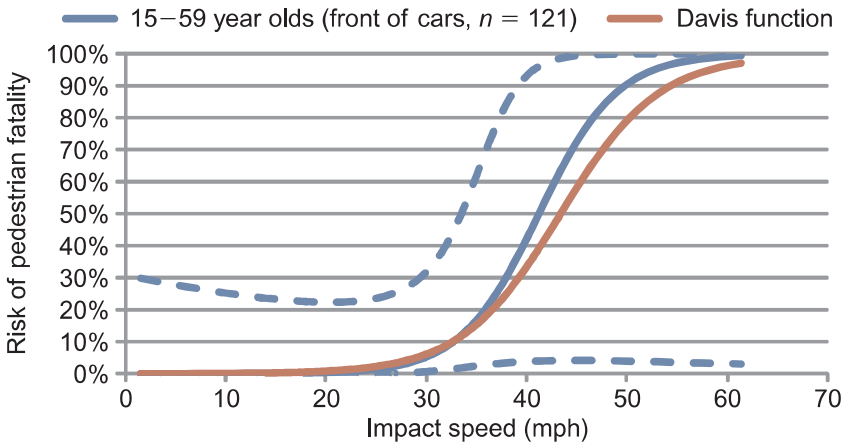
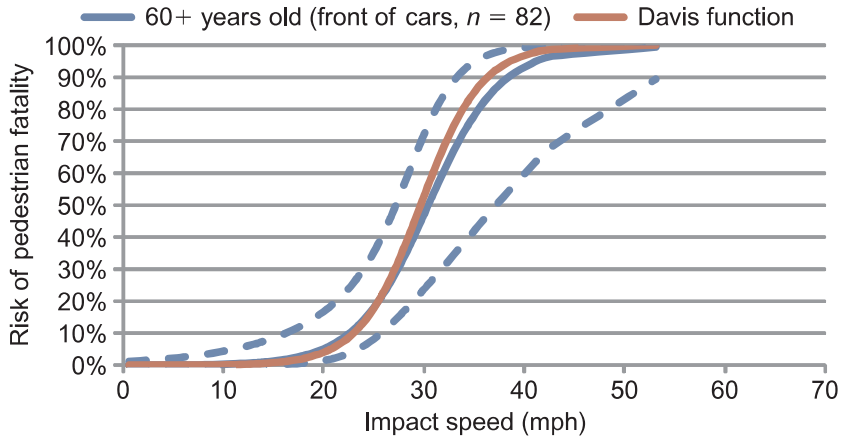


Figure 2.4: Risk of elderly pedestrian fatality calculated using logistic regression from Ashton and Mackay data compared with the Davis function



These three figures all show that the curves calculated using logistic regression are very similar to the curves calculated by Davis, particularly at lower speeds. As the impact speed increases, the lines start to diverge, with logistic regression giving slightly larger estimates of risk for children and adults, and lower estimates for elderly pedestrians. However, the sensitivity of the precision of these results to the sample size should be noted: the sample size has been split into three, and the confidence intervals have become much wider as a result, particularly for children and adults. For elderly pedestrians, the confidence intervals remain relatively narrow. This is because of the large proportion of fatalities in this sub-sample, which means that the estimate of fatality risk is more precise.

These figures highlight the fragility of elderly pedestrians. At an impact speed of 30 mph, the risk of fatality for elderly pedestrians is 47%, compared with 5% for adults and 4% for children.

2.2.2 GIDAS data

2.2.2.1 Literature

The German In-Depth Accident Study (GIDAS) is the largest in-depth accident study in Germany. Since mid-1999, the GIDAS project has collected on-scene accident cases in the areas of Hannover and Dresden. GIDAS collects data from accidents of all kinds and, due to the on-scene investigation and the full reconstruction of each accident, gives a comprehensive view on the individual accident sequences and its causation. The project is funded by the Federal Highway Research Institute (BASt) and the German Research Association for Automotive Technology (FAT), a department of the German Association of the Automotive Industry (VDA).

In a study exploring the possible effectiveness of pedestrian protection measures, Hannawald and Kauer (2004) produced an injury risk function using data collected by GIDAS. This used a sample of 712 pedestrians, which were all struck by the front of cars. Hannawald and Kauer compared impact speed with the risk of being fatally injured, where 'fatal' injury was defined as pedestrians receiving a Maximum Abbreviated Injury Score (MAIS) of five or six. This is likely to have been a good approximation – all pedestrians with a MAIS of six are fatally injured by definition, and the majority of pedestrians with a MAIS of five are likely to die.

Hannawald and Kauer calculated their injury risk functions using logistic regression; however, it is not known whether they weighted the data in their sample to match the proportion of pedestrian casualties seen nationally.

A more recent study by Rosén and Sander (2009) also used GIDAS data to calculate the relationship between impact speed and the risk of pedestrian fatality. This sample included pedestrian impacts occurring between 1999 and 2007, where the pedestrian was hit by the front of the car and the impact speed was known. Pedestrians hit by sport utility vehicles, pedestrians who were lying down, and pedestrians who were 'sideswiped' were removed from the sample. The final sample that was used contained 490 pedestrians aged 15–96, including 36 fatalities. There were no children under the age of 15 in the GIDAS pedestrian dataset. The number of fatal, serious and slight casualties in this sample was weighted to the number of pedestrian casualties in Germany from 2003 to 2007. Rosén and Sander used logistic regression to calculate the relationship between impact speed v (in kilometres per hour) and the risk of pedestrian fatality P. The relationship found was:

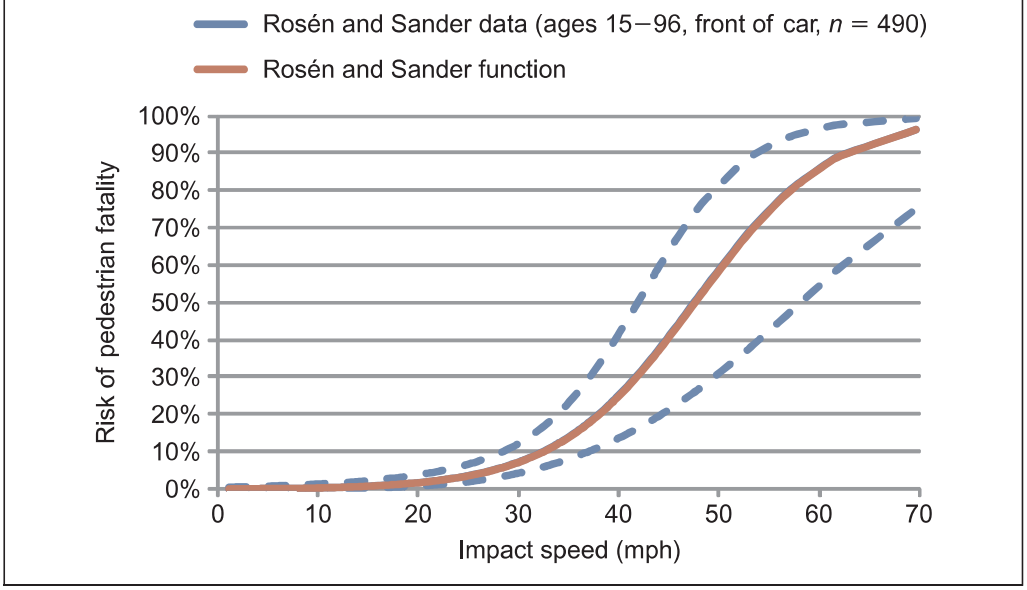
$$P = \frac{1}{1 + e^{6.9 - 0.090v}} \tag{2.5}$$

Rosén and Sander did not publish full details of their sample. However, through collaboration with Autoliv, it was possible to analyse the relevant dataset for use in this project.

2.2.2.2 Results of logistic regression

Figure 2.5 shows the results of using the logistic regression on the GIDAS data supplied by Rosén and Sander, and also shows the function calculated by Rosén and Sander themselves. These data contains pedestrians aged 15–96 years. Only one of these curves is visible because the results are identical: the logistic regression method matches that used by Rosen and Sander themselves. This figure shows that the risk of a pedestrian fatality at an impact speed of 30 mph is approximately 7%, and the risk of fatality at 40 mph is approximately 25%.

Figure 2.5: Risk of a pedestrian fatality calculated using logistic regression from the Rosen and Sander GIDAS dataset



2.2.3 *OTS and police fatal file data*

2.2.3.1 Overview

As part of this study, pedestrian casualties recorded in the On the Spot (OTS) study and police fatal files have been used to estimate the relationship between impact speed and pedestrian injury severity.

The OTS study began in 2000 and finished in 2010. It was funded by the Department for Transport and the Highways Agency. It aimed to establish an in-depth database that could be used to improve the understanding of the causes and consequences of road traffic collisions, and thus aid the Government in reducing road casualties.

There were two OTS teams: the Transport Research Laboratory (TRL), covering the Thames Valley area, and the Vehicle Safety Research Centre (VSRC), attached to Loughborough University and covering Nottinghamshire. Expert investigators from these teams attended the scenes of collisions, usually within 15 minutes of an accident occurring, using dedicated response vehicles and equipment. In total, the teams made in-depth investigations of about 500 collisions per year, and recorded in excess of 3,000 pieces of information about each collision. This information includes the speeds of the vehicles involved, including the speed of the vehicle at impact in a pedestrian accident. These speeds are based on evidence at the scene, witness statements and the expert judgement of experienced accident investigators.

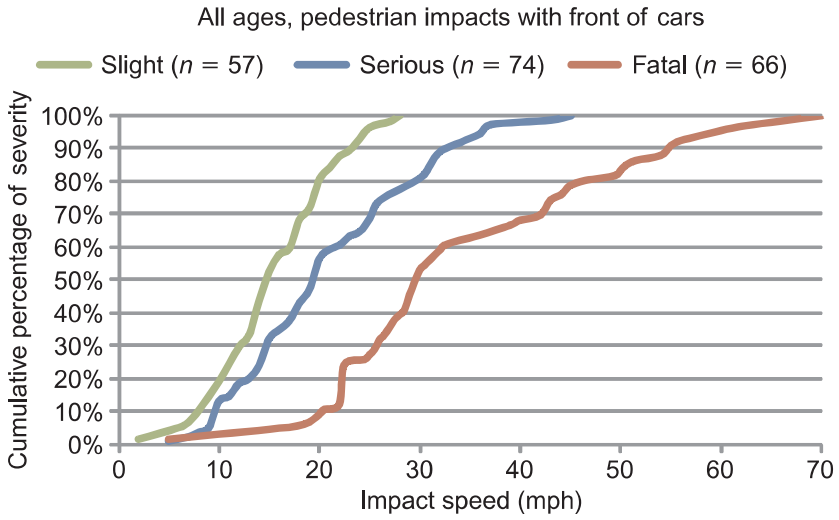
Police fatal file collision reports contain information arising from police investigations into fatal traffic collisions, and provide detailed information on the events leading up to a collision, as well as giving details of driver errors and/or vehicle defects which may have contributed to the collision and to the injuries that resulted in the fatality. They provide a unique insight into how and why fatal collisions occur.

Since 1992, TRL, on behalf of the Department for Transport, has received fatal files from police forces in England and Wales. The current archive contains over 34,000 police fatal collision reports.

From the pedestrian accidents in OTS and the police fatal files, a sample of 197 pedestrian casualties was obtained, including 66 fatalities. These pedestrians were hit by the front of cars, in accidents occurring from 2000 to 2009. Accidents where the pedestrian was lying down, or where the vehicle ‘sideswiped’ the pedestrian, were excluded. All ages of pedestrian casualty were included in the sample, including those of unknown age.

Figure 2.6 shows the cumulative impact speed of the pedestrians in the OTS and police fatal file dataset. This shows that approximately half of the fatally injured pedestrians in the dataset were hit at an impact speed of 30 mph or less. In order to perform the logistic regression, the number of slight, serious and fatal casualties in this dataset was weighted to match the number of pedestrian casualties in the national statistics (which was shown in Table 2.2).

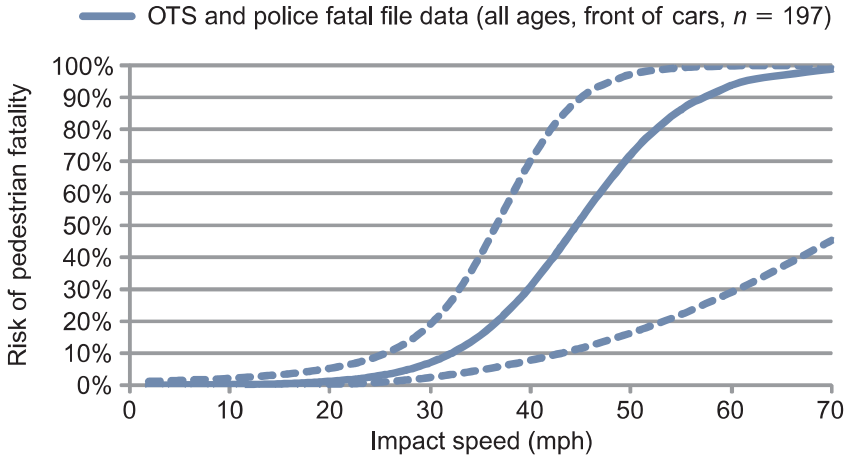
Figure 2.6: Cumulative impact speed for pedestrian casualties in the OTS and police fatal file dataset



2.2.3.2 Results of logistic regression

Figure 2.7 shows the relationship between impact speed and the risk of pedestrian fatality, calculated using the logistic regression method. This figure gives the risk of pedestrian fatality at an impact speed of 30 mph as approximately 7%, and the risk at an impact speed of 40 mph as approximately 31%. The number of cases in the sample is too small to allow the results to be broken down by age group.

Figure 2.7: Risk of pedestrian fatality calculated using logistic regression from the OTS and police fatal file dataset



2.2.4 Other sources of data

The Ashton and Mackay, GIDAS, and OTS and police fatal file datasets are the largest and most widely used datasets available for calculating the risk of pedestrian fatality with impact speed. However, in the literature there are other examples of pedestrian datasets that have been used for this purpose, which are discussed briefly here.

Anderson *et al.* (1997) investigated the relationship between reduced travel speeds and the incidence of pedestrian fatalities. As part of this, the probability of pedestrian fatality by impact speed was derived. This was based on a combination of the relationship between injury severity score (ISS) and impact speed (from Interdisciplinary Working Group for Accident Mechanics, 1986), and the relationship between ISS and the risk of being fatally injured (from Walz *et al.*, 1983). These studies were based on data collected in Switzerland in 1978 and 1981. However, this dataset was biased towards more severe injuries, and there are no details of any weighting procedure given.

Oh *et al.* (2008) developed a model for the risk of pedestrian fatality based on accident data collected in Korea from 2004 to 2005. The expression calculated for the risk of pedestrian fatality (P) with respect to impact speed (v) in kilometres per hour was as follows:

$$P = \frac{1}{1 + e^{5.433 - 0.095v}} \tag{2.6}$$

This expression was calculated using a binary logistic regression technique. However, this paper does not mention whether the sample of pedestrian accidents was representative of all pedestrian accidents in Korea, or whether it was weighted in any way.

3 CAR DRIVER INJURY RISK CURVES

In addition to exploring the relationship between impact speed and pedestrian injury, this study also looks at the relationship between speed and car driver injury severity. The process used is the same as that used for the pedestrian injury risk curves: the data in the sample are weighted to match the proportion of casualties which occur nationally, and logistic regression is used to calculate the relationship between speed and injury. The only things that differ are the source of the data and the definition of speed.

The data for the car driver injury risk curves come from accidents recorded in the On the Spot (OTS) study (described in Section 2.2.3.1), and also accidents recorded in the Co-operative Crash Injury Study (CCIS).

CCIS collected in-depth real-world accident data between 1983 and 2010. Vehicle examinations were undertaken at recovery garages several days after the collision. Car-occupant injury information was collected and questionnaires were sent to survivors. Collisions were investigated according to a stratified sampling procedure which favoured cars containing fatal or seriously injured occupants, as defined by the British Government definitions of fatal, serious and slight. The study focused on collisions involving cars which were less than eight years old at the time of the collision. More information on the data collection methods employed can be found at www.ukccis.org.

The measure of speed used to draw the speed–injury risk curves for the car drivers was the change of velocity, or delta-v, of their vehicles. In this case, delta-v is a better predictor of injury than other measures of speed, such as the impact speed or closing speed, because it takes into account the characteristics of the vehicle, such as vehicle weight and stiffness, in addition to the initial speeds of the vehicles involved. As an example of the calculation of the change in velocity, consider a front–front impact between two identical cars, both travelling at 30 mph. Conservation of momentum means that these cars will come to rest on impact, therefore they will each have a delta-v of 30 mph. If one of the cars was initially stationary, after impact they would move off at a speed of 15 mph, and the delta-v for each vehicle would be 15 mph. The delta-v is calculated in exactly the same way for a side impact; if a stationary car is hit in the side by an identical car travelling at 30 mph, both vehicles will move off at 15 mph, giving them both a delta-v of 15 mph.

Figure 3.1 shows the cumulative delta-v for the cars in frontal impacts split by the injury severity of the car drivers. This sample includes car drivers who were wearing a seat belt in a car receiving one single significant impact to the front, where this impact was with another car. Drivers in vehicles which rolled over were excluded. The cumulative data are not weighted – weighting the data would not change the

form of the cumulative speed curves. This figure shows that half of drivers who were fatally injured were in an impact with a change in velocity of 34 mph or less.

Figure 3.1: Cumulative speed curves for car drivers in cars with a frontal impact

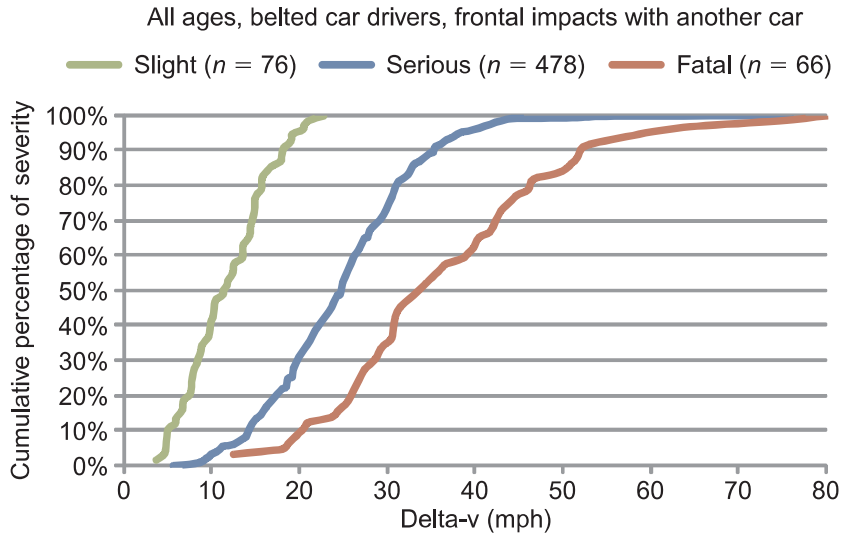
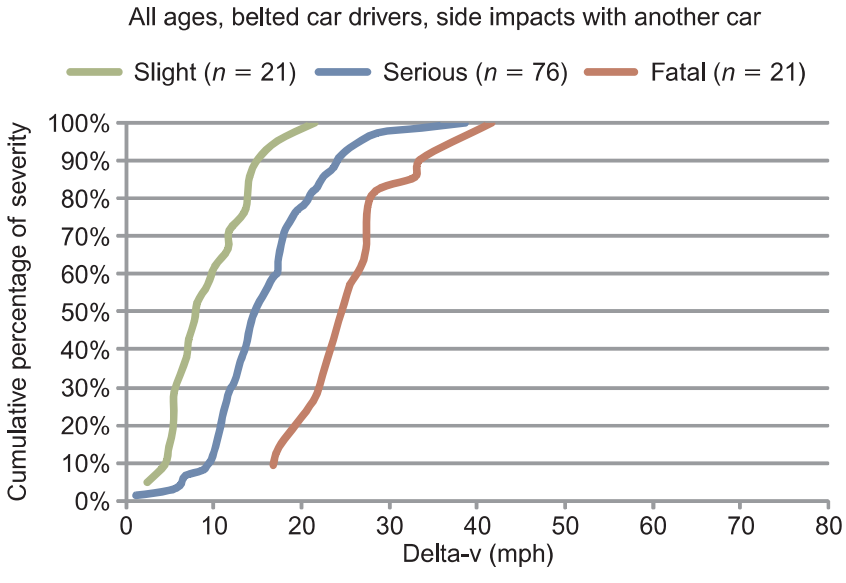


Figure 3.2 shows the cumulative delta-v of the cars in side impacts. This sample includes cars that were struck on the offside by another car and where the driver was seated on the offside of the car (i.e. the drivers are seated on the struck-side of the vehicle). Similarly to the frontal impact sample, this only includes belted drivers receiving a single significant impact to the side of the car, in impacts with another car. Drivers in cars that rolled over were excluded. This figure shows that half of the fatally injured drivers in the sample were in impacts with a change in velocity of 24 mph or less.

Figure 3.2: Cumulative speed curves for car drivers in side impacts



3.1 Weighting the data

A very similar process to that used for pedestrian casualties (in Section 2.1.1) was used to weight the data for car drivers. Table 3.1 shows details of the weighting for car drivers in frontal impacts, and Table 3.2 shows the weighting for car drivers in side impacts. As the CCIS and OTS sample excluded drivers who were not wearing a seat belt, the weighting procedure takes into account the proportion of STATS19 casualties that were wearing a seat belt, and weights to this number. Because STATS19 does not record seat-belt wearing, this proportion was estimated using the information available in CCIS.

Table 3.1: Sample size and weighting for car drivers in frontal impacts

Injury severity	Sample from CCIS/OTS	Sample in STATS19	Seat-belt wearing rates in CCIS (%)	Weighting factors
Fatal	66	479	73	5.23
Serious	478	6,744	83	11.7
Slight	76	81,642	89	956

Table 3.2: Sample size and weighting for car drivers in side impacts

Injury severity	Sample from CCIS/OTS	Sample in STATS19	Seat-belt wearing rates in CCIS (%)	Weighting factors
Fatal	21	119	80	4.53
Serious	76	1,275	91	15.3
Slight	21	24,141	94	1,081

It should be noted that there are some slight and serious accidents which are not reported to the police, and are therefore not present in the national statistics (Department for Transport, 2009). This means that, once the results are weighted, they are likely to give an overestimate of the risk of fatality.

3.2 Results of logistic regression

Figure 3.3 shows the risk of car driver fatality in frontal impacts, by the delta-v of the impact. This figure shows that the risk of car driver fatality in an impact with a delta-v of 30 mph is approximately 3%, at 40 mph the risk is approximately 17%, and at 50 mph the risk is approximately 60%.

Figure 3.3: Risk of car driver fatality calculated using logistic regression from the OTS and CCIS dataset

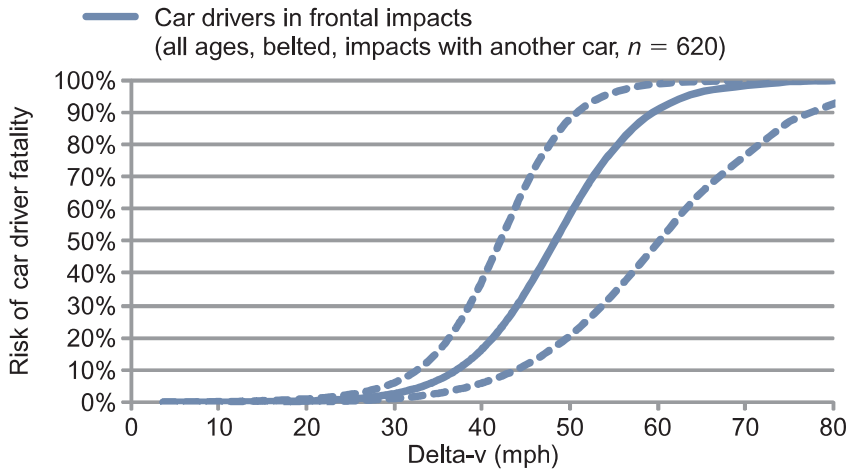
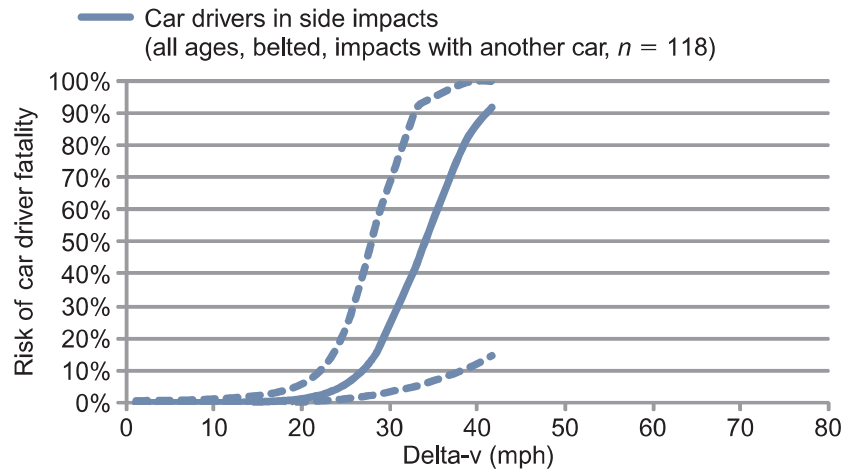


Figure 3.4 shows the risk of car driver fatality in side impacts. It is immediately apparent that the risk in side impacts is much higher than in frontal impacts. For a side impact with a delta-v of 30 mph, the risk of fatality is approximately 25%. For a delta-v of 40 mph, the risk of fatality is approximately 85%.

Figure 3.4: Risk of car driver fatality calculated using logistic regression from the OTS and CCIS dataset



4 DISCUSSION

4.1 Pedestrian injury risk curves

The same method of logistic regression has been applied to in-depth pedestrian accident data collected in Great Britain in the 1970s, in Germany from 1999 to 2007, and in Great Britain from 2000 to 2009. As the same method has been used to calculate the risk of pedestrian fatality with impact speed, the results from these datasets can be directly compared. This comparison is shown in Figure 4.1, which shows the risk of pedestrian fatality with impact speed for the three different datasets. The fatality risk at impact speeds of 30 mph and 40 mph are also shown in Table 4.1.

The comparison between the Ashton and Mackay data from the 1970s and the more recent accident data suggests that there has been a decrease in the risk of pedestrian fatality for impact speeds of 30 mph or greater. However, this should be treated with caution due to the relatively small sample sizes and confidence intervals surrounding the risk estimates. A decrease would be expected for two reasons. The first is the improvement in car design, meaning that pedestrians are less likely to be fatally injured if they are hit at the same speed by a newer car. The second reason is improvement in medical care, which means that pedestrians can survive injuries now that would have been fatal in the 1970s.

Comparison of the two new pedestrian accident datasets indicates a difference in injury risk for impacts at a speed above 35 mph. Above these speeds, the risk of fatality is greater for the On the Spot (OTS) and police fatal file dataset. Because the same method of logistic regression has been used, the differences between these results must be due to differences in the two datasets. The most apparent differences between the two datasets are that the Rosén and Sander dataset does not include any children under the age of 15, and does not include any impacts with sports utility vehicles. Either of these differences could explain why the OTS and police fatal file dataset gives slightly higher fatality risks at higher speeds compared with the Rosén and Sander dataset, although the number of children and SUVs in the dataset was small.

Figure 4.2 shows the risk of pedestrian fatality for pedestrians aged 15 years or older. This enables a better comparison with the Rosén and Sander sample. The risk of fatality at 30 mph and 40 mph is also given for these adult pedestrians in Table 4.1. Removing the children from the OTS and police fatal file dataset increases the calculated risk of pedestrian fatality slightly, meaning that the difference between the GIDAS and the OTS and fatal file datasets increases. The differences between these two datasets must be due to more than just the absence of children in the GIDAS dataset. When the child pedestrians are removed from the Ashton and Mackay dataset, the risk of fatality also increases, and by a larger amount than was seen in the OTS and police fatal file dataset.

Generally, it appears that the risk of fatality for child pedestrians is less than the risk of fatality for pedestrians aged 15 or older. This agrees with Figures 2.2–2.4, which showed that the risk of pedestrian fatality is similar for children and adults, and higher for elderly pedestrians.

Figure 4.1: Risk of pedestrian fatality calculated using logistic regression from the Ashton and Mackay, OTS and police fatal file, and Rosen and Sander datasets

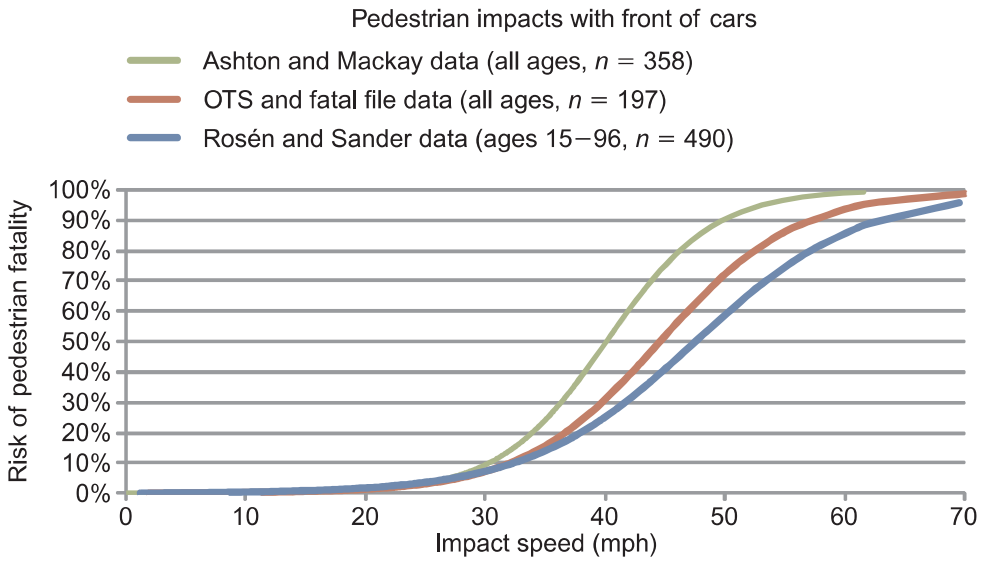


Figure 4.2: Risk of pedestrian fatality for pedestrians aged 15 years or older. Calculated using logistic regression from the Ashton and Mackay, OTS and police fatal file, and Rosen and Sander datasets

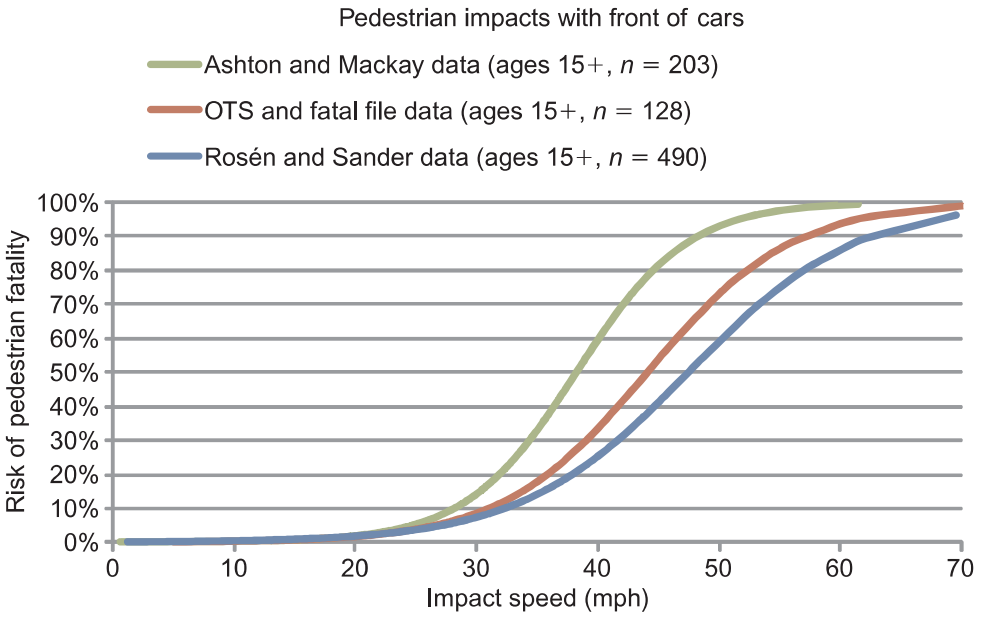


Table 4.1: Risk of pedestrian fatality at impact speeds of 30 mph and 40 mph for the three pedestrian datasets		
Dataset	**Risk of fatality for impact speed**	
	30 mph (%)	**40 mph (%)**
Ashton and Mackay (all ages)	9	50
Ashton and Mackay (ages 15+)	14	60
OTS and police fatal file (all ages)	7	31
OTS and police fatal file (ages 15+)	9	33
GIDAS (Rosén and Sander) (ages 15+)	7	25

Although Figure 4.1 shows apparent differences between the three datasets, it is clear from Figures 2.1, 2.5 and 2.7 that the confidence intervals around each curve also encloses the curves of the other two datasets. The large confidence intervals around each curve highlight the large variability of fatality risk, and that it depends on many other factors as well as impact speed. Age, gender, biomechanical tolerance, the part of the vehicle hit, and many other variables are all related to the risk of pedestrian fatality.

Although the absolute values of risk differ between the three datasets, the increase in fatality risk with impact speed follows a similar pattern in all three. There is a gradual rise of risk up to impact speeds of around 30 mph. Above 30 mph the risk of fatality increases more rapidly with respect to speed:

- in the Ashton and Mackay dataset, the risk increases 5.5 times from 30 to 40 mph;
- in the OTS and police fatal file dataset, the risk increases 4.5 times from 30 to 40 mph; and
- in the Rosén and Sander dataset, the risk increases 3.5 times.

It should be noted that these curves give the risk of fatality **provided that the pedestrian has been injured**. This is because no details have been included of any pedestrians that were hit by vehicles, but were not injured. Although OTS does record details of road users who were not injured in accidents, the national statistics do not include this information. However, it is a good assumption that the vast majority of pedestrians hit by the front of a moving car will receive at least slight injuries (which can be as minor as a bruise), therefore these curves are a good approximation of the risk of fatality which could be calculated if the number of non-injured pedestrians was known.

It is known that there are some slight and serious road traffic accidents that are not reported to the police in Great Britain (Department for Transport, 2009) and are therefore not included in the national statistics. Because the risk of pedestrian fatality was calculated by weighting the OTS and police fatal file dataset to match

the proportion of fatal, serious and slight casualties nationally, this under-reporting in the national statistics will have an effect on the calculated risk. The effect will be that the risk is overestimated.

The accuracy of the curves drawn from the Ashton and Mackay data is limited by the information available in that pedestrian dataset. The results of this study, and also that of Davis (2001) and Pasanen (1992) rely on data published in tables in Ashton (1980), which groups the impact speed into categories of 10 km/h. The assumption has been made that the impact speed is uniformly distributed within these groups, but without access to the original pedestrian dataset from the 1970s it is impossible to know how good an assumption this is. However, it seems unlikely that the differences would be large enough to alter the risk curve so that there no longer appeared to be a reduction in pedestrian injury risk since the 1970s.

There have been other studies that have investigated the risk of pedestrian fatality with impact speed, most notably using data from Switzerland and Korea. However, neither of these studies appears to weight the results in any way, so they cannot be deemed representative of the risk of pedestrian fatality in Switzerland or Korea.

Although this study suggests that the **risk** of pedestrian injury at an impact speed of 30 mph is approximately 7%, the cumulative impact speed curves in Figure 2.6 show that approximately half of the fatally injured pedestrians in the OTS and police fatal file sample were hit at impact speeds of 30 mph or less. A recent study using STATS19 (Crinson *et al.*, 2009) saw that over 60% of pedestrian fatalities occurred in an area where the speed limit was 30 mph or lower. Although the risk of pedestrian fatality may seem relatively low at 30 mph, the large number of pedestrian accidents at these speeds leads to a lot of pedestrian fatalities at 30 mph or less.

4.2 Car driver injury risk curves

The car driver injury risk curves highlight the difference in risk for drivers in frontal impacts and those on the struck side in a side impact. It is much more likely that a driver will suffer a fatal injury if they are involved in a struck side impact. For a delta-v of 30 mph, the risk of fatality in a frontal impact is 3% compared with 25% in a struck side impact. At 40 mph, the risk is 17% in a frontal impact compared with 85% in a side impact. This reflects the differing mechanics of a frontal and a side impact.

In a frontal impact, there is a large crush zone in the front of the vehicle, which can absorb the energy of the impact, and which means that the change in velocity occurs over a longer timescale. Restraint systems, including seatbelts and airbags, are also at their most effective in a frontal impact. In a side impact, there is relatively little space between the outside of the door and the seating position of the driver. This

explains why impacts with the same delta-v are more likely to be fatal if the car is struck on the driver side than if it is hit on the front.

Although the risk of fatality in a frontal impact at 30 mph is relatively low, the cumulative impact speed curves show that approximately 35% of fatalities occur at this delta-v or below. The large number of collisions at these speeds means that large numbers of people are killed at these speeds, even though the risk of fatality in each individual collision is low.

The sample of car drivers in frontal impacts is much larger than the sample in side impacts and the sample of pedestrians (620 in frontal impacts, 118 in side impacts, 197 pedestrians). Although this means that the confidence intervals are narrower, they still include a wide range of risk values, particularly at higher impact speeds. In the same way as for pedestrians, this highlights the large number of factors in addition to speed which affect the risk of a car driver receiving fatal injuries.

5 CONCLUSIONS

This study has explored the relationship between speed and the risk of being killed for three groups of casualties: pedestrians hit by the front of a car, belted car drivers involved in a frontal impact with another car, and belted car drivers in side impacts with another car. This relationship has been calculated in the same way for these three types of impact: first the datasets have been weighted to match the national proportion of casualties, and then logistic regression has been used to calculate the relationship between the risk of fatality and speed. Data from three pedestrian datasets (for Great Britain in the 1970s, Germany from 1999 to 2007, and Great Britain from 2000 to 2009) have been treated in the same way to allow comparison. The conclusions of this study are as follows:

- The three pedestrian datasets show a similar pattern in fatality risk. The risk increases slowly until impact speeds of around 30 mph. Above this speed, risk increases rapidly – the increase is between 3.5 and 5.5 times from 30 mph to 40 mph.
- The risk of fatality is generally higher for the dataset from the 1970s, indicating that the risk of pedestrian fatality has reduced over the last 30 years.
- Even though the risk of pedestrians being killed at 30 mph is relatively low, approximately half of pedestrian fatalities occur at this impact speed or below.
- The risk of a belted car driver being killed in an impact with another car is much higher in a side impact than in a frontal impact with the same change of velocity.

6 ACKNOWLEDGEMENTS

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CCIS was managed by TRL, on behalf of the United Kingdom Department for Transport who funded the project along with Autoliv, Ford Motor Company, Nissan Motor Company, Toyota Motor Europe, Daimler Chrysler, LAB, Rover Group Ltd, Visteon, Volvo Car Corporation, Daewoo Motor Company Ltd and Honda R&D Europe(UK) Ltd.

Data were collected by teams from the Birmingham Automotive Safety Centre of the University of Birmingham; the Vehicle Safety Research Centre (VSRC) at Loughborough University; TRL and the Vehicle and Operator Services Agency of the Department for Transport.

Further information on CCIS can be found at www.ukccis.org.

The On the Spot (OTS) project was funded by the Department for Transport and the Highways Agency. The OTS investigations were carried out by teams at TRL in Berkshire and VSRC at Loughborough University. The project would not have been possible without the help and support from many individuals, especially the chief constables of Nottinghamshire and Thames Valley police forces, and their officers.

This project uses accident data from the police fatal accident reports which are archived and stored for research purposes by a project funded by the Department for Transport.

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APPENDIX 1

Logistic regression input and output

A1.1 Input for logistic regression

The method of logistic regression required three variables for each pedestrian in each of the datasets used. These variables were the impact speed, a binary value for whether the pedestrian was fatally injured (0 = not fatal, 1 = fatal), and the weighting applied to that pedestrian so that the sample represents the national proportion of slight, serious and fatal pedestrian casualties.

In the German In-Depth Accident Study (GIDAS) dataset (supplied by Rosén and Sander) and the On the Spot (OTS) and police fatal file dataset, these variables were all available or easily calculated. However, the Ashton and Mackay data, published in Ashton (1980), grouped the casualties into categories of 10 km/h. In order to perform the logistic regression, the same assumption was made as that which Davis (2001) used on these data. The assumption was that, within these 10 km/h groups, the impact speeds were uniformly distributed. For example, if there were 10 pedestrians with impact speeds in the range of 31–40 km/h, it was assumed that the impact speeds were 31, 32, 33, 34, 35, 36, 37, 38, 39 and 40 km/h.

A1.2 Example R code

Below is an example of the R code that was used to calculate the speed–injury risk curves for the Ashton and Mackay sample of pedestrians:

```
#Read the data file
#Variables in the data file include:
#Impact_speed: impact speed
#Fatal: binary value, 0 = not fatal, 1 = fatal
#Weighting_by_total_sample: values used to weight data to national
statistics

pedestrians<-read.table(''Ashton_Mackay_total_sample.dat'',header=TRUE)

#Check the first four records of the data file to ensure correct file is being used

pedestrians[1:4,]
```

```
#Performs the logistic regression, and outputs a summary of the results

glmfit<-glm(Fatal~Impact_speed,data=pedestrians,
family=quasibinomial,weight=Weighting_by_total_sample)

summary(glmfit)

#Produces the values required to calculate the risk of fatality for each
impact speed in the data file. This produces two outputs - one to calculate the
risk curve, and a second output to calculate the confidence intervals

predict(glmfit,se=TRUE)
```

A1.3 Output from R

This section shows the R output produced from the above code:

```
>pedestrians<-read.table(''Ashton_Mackay_total_sample.dat'',header=TRUE)>
pedestrians[1:4,]

ID        Impact_speed      Weighting_by_total_sample   Fatal
1         0.309             412.6518                    0
2         0.927             412.6518                    0
3         1.545             412.6518                    0
4         2.163             412.6518                    0

>glmfit<-glm(Fatal~Impact_speed,data=pedestrians,
family=quasibinomial,weight=Weighting_by_total_sample)

> summary(glmfit)

Call:
glm(formula = Fatal ~ Estimated_speed_total_sample, family = quasibinomial,
data = pedestrians, weights = Weighting_by_total_sample)

Deviance Residuals:
Min 1Q Median 3Q Max
-17.4606 -2.6765 -1.3786 -0.4227 18.6874

Coefficients:
Estimate Std. Error t value Pr(>|t|)
(Intercept) -9.02328 1.56829 -5.754 1.88e-08 ***
Impact_speed                0.13968 0.03124 4.471 1.05e-05 ***
- - -
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
(Dispersion parameter for quasibinomial family taken to be 202.5878)
```

```
Null deviance: 20230 on 357 degrees of freedom
Residual deviance: 12793 on 356 degrees of freedom
AIC: NA

Number of Fisher Scoring iterations: 5

> predict(glmfit,se=TRUE)

$fit
  1 2 3 4 5 6
-8.98012348 -8.89380102 -8.80747856 -8.72115610 -8.63483364 -8.54851117
#Only first 6 values of output included. These are the x values referred to in
Section A1.4.

$se.fit
  1 2 3 4 5 6
1.5588796 1.5400672 1.5212674 1.5024803 1.4837067 1.4649470
#Only first 6 values of output included. These are the y values referred to in
Section A1.4 - the standard error of the x values.

$residual.scale
[1] 14.23333
```

A1.4 Drawing curves from the R output

The output generated by the R code 'predict(glmfit,se=TRUE)' formed the basis of the pedestrian injury risk curves. The output under '$fit' contained the information necessary to draw the risk curve, and the output under '$se.fit' provided the information necessary to draw the confidence intervals.

The risk of fatality, *P*, at each impact speed was calculated using:

$$P = \frac{e^x}{1 + e^x} \tag{A1.1}$$

where x is the value given by the output of the '$fit' logistic regression for each impact speed.

The lower confidence interval was calculated using the standard error given in the R output under '$se.fit', using the following formula:

$$P = \frac{e^{x-1.96y}}{1 + e^{x-1.96y}} \tag{A1.2}$$

and a similar formula for the upper confidence interval:

$$P = \frac{e^{x+1.96y}}{1 + e^{x+1.96y}} \tag{A1.3}$$

where y is the value given for the standard error by the '$se.fit' R output. The value of 1.96 times the standard error results in the confidence intervals having a 95% chance to contain the true value of risk at each impact speed.

APPENDIX 2

Comparison of the logistic and Bayesian approach

This appendix compares the results of two possible methods of calculating risk cures – logistic regression (as used in the main body of the report), and an approach using Bayes theorem. These results are compared using the On the Spot (OTS) and police fatal file dataset of pedestrian casualties.

The logistic form for the risk–speed relationship is widely used in the literature, including Rosén and Sander (2009). Pasanen (1992) used a quadratic form for the regression, however, for the OTS and police dataset a quadratic form does not explain any more of the variation in the data. This may not be the case for the other datasets.

The form for the pedestrian fatal casualty relationship with impact speed (kilometres per hour) is given by:

$$\Pr\left(\textit{fatal casualty}|\textit{impact speed}\right) = \frac{1}{1+e^{-z}} \qquad \text{(A2.1)}$$

where $z = -7.850 + 0.1095$*Impact_speed(km/h).

Whereas the use of the logistic regression makes an assumption about the form of the 'S' shaped relationship, the Bayes approach does not. It does, however, depend on assuming that the speed distribution is Normal. The probability of pedestrian fatality using Bayes' theorem is given by the following:

$$\Pr\left(F|v\right) = \frac{f(v|F)\,p_0(F)}{f(v|F)\,p_0(F) + f(v|Se)\,p_0(Se) + f(v|Sl)\,p_0(Sl)} \qquad \text{(A2.2)}$$

where *F*, *Se* and *Sl* denote fatal, serious and slight injury collisions, respectively, and $f(v/F)$, etc., denote the probability density functions of speed (v) for each of the three severities of collision. The 'prior' probabilities $p_0(F)$, $p_0(Se)$ and $p_0(Sl)$ can be calculated from Table 2.2, and are given in Table A2.1. Table A2.1 summarises the characteristics of the OTS and police fatal file dataset.

There is no particular evidence of these speed distributions not being Normal, although the fatal distribution is slightly skewed. This is confirmed by the plots of the speed data, shown in Figures A2.1–A2.3.

Table A2.1: Characteristics of impact speed (mph) distribution of OTS and police fatal file dataset

Statistic	Slight	Serious	Fatal
Mean	16.45	21.61	34.38
Standard error (se)	0.81	1.06	1.73
Median	15.50	20.00	30.00
Mode	12.00	20.00	22.50
Standard deviation	6.31	9.45	14.15
Sample variance	39.77	89.36	200.27
Kurtosis	0.30	-0.62	-0.06
Skewness	0.35	0.33	0.67
Range	33.00	42.00	65.00
Minimum	2.00	3.00	5.00
Maximum	35.00	45.00	70.00
Count	60	79	67
'Prior' probability of pedestrian casualty outcome (from Table 2.2)	0.75960	0.21669	0.02371

Figure A2.1: Speed distribution of slightly injured pedestrian casualties in the OTS and police fatal file dataset

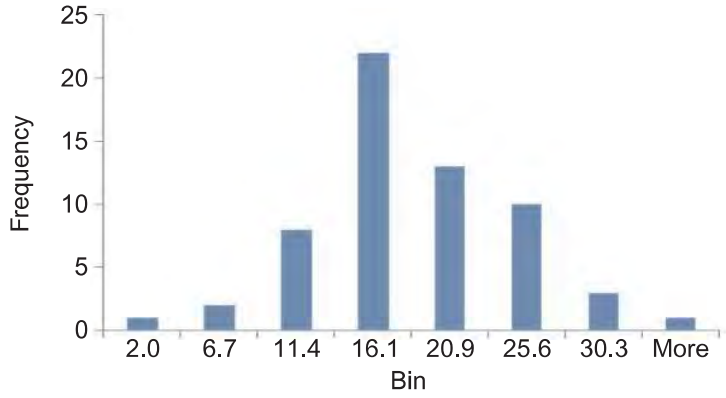


Figure A2.2: Speed distribution of seriously injured pedestrian casualties in the OTS and police fatal file dataset

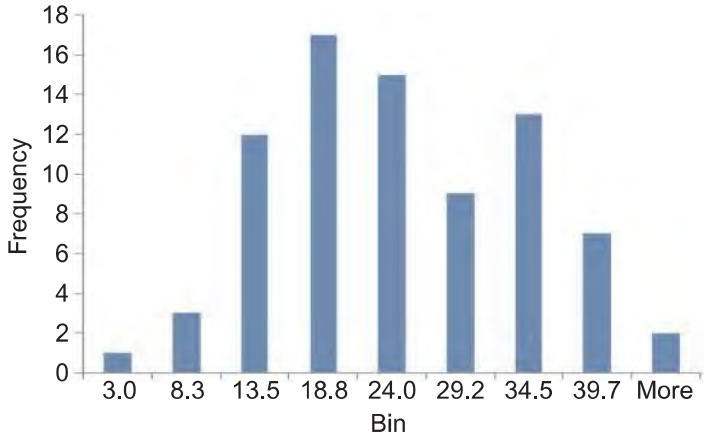
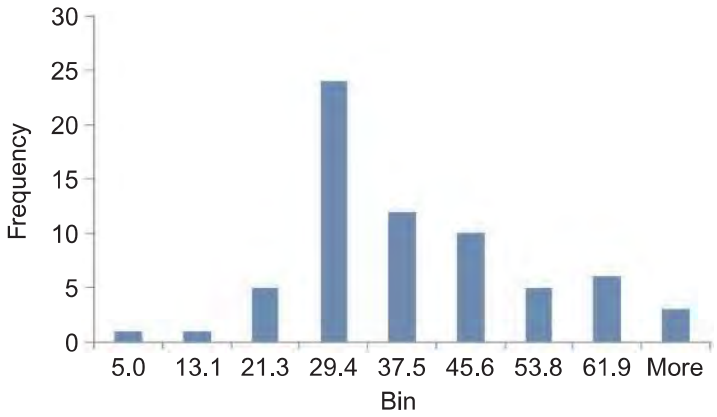


Figure A2.3: Speed distribution of fatally injured pedestrian casualties in the OTS and police fatal file dataset



Under the assumption that the speed distributions are Normally distributed and applying Bayes theory with the prior probabilities of pedestrian casualty (as given in Table A2.1), estimates of the risk of pedestrian fatality with impact speed, with 95% confidence intervals, were calculated. These are shown for fatal pedestrian casualties in Table A2.2.

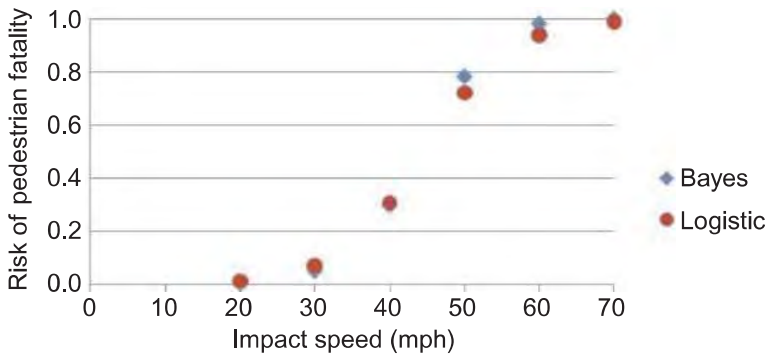
Table A2.2: Results of pedestrian fatality risk using Bayesian and logistic approaches

Impact speed (mph)	Bayesian approach	Logistic regression approach		
	Bayes estimate	Logistic	Lower*	Upper*
20	0.008	0.013	0.003	0.054
30	0.055	0.071	0.025	0.190
40	0.303	0.309	0.078	0.702
50	0.783	0.723	0.164	0.972
60	0.982	0.938	0.291	0.998
70	0.999	0.989	0.455	1.000

*95% confidence interval for the estimate as derived from the logistic regression.

The Bayesian approach tends to produce lower probabilities than the logistic regression for lower impact speeds, but higher ones for higher impact speeds – which suggests a 'steeper' slope on the risk–speed relationship. However, the Bayesian estimates were all within the 95% confidence interval surrounding the logistic regression estimates. The association between the two estimates is quite strong, as illustrated in Figure A2.4.

Figure A2.4: Risk of pedestrian fatality using Bayesian and logistic methods in the OTS and police fatal file dataset



There is some uncertainty associated with the assumption that the speed distributions are all Normal. The Bayes approach requires the probability for a specific impact speed and that a certain level of severity has occurred, i.e. the probability that speed is, say, 20 mph when a slight injury occurs. This will not change by much for small deviations from the Normality assumption. This was illustrated by using 95% confidence interval values for the mean impact speed, i.e. instead of using the mean speed when calculating the probability, the mean ± 1.96*se was used and this resulted in only small differences in the Bayesian estimate.

It is evident from this additional analysis that using a Bayesian approach does generate slightly different probabilities than those from the weighted logistic regression, but in practice they are probably not sufficiently different to be of concern.

APPENDIX 3

Data tables

This appendix contains tables (Tables A3.1–A3.3) of the On the Spot (OTS) and police fatal file dataset of pedestrians, and the Co-operative Crash Injury Study (CCIS) and OTS dataset of car occupants. Tables of the Ashton and Mackay data can be found in Ashton (1980), and more information on the German In-Depth Accident Study (GIDAS) data can be found in Rosén and Sander (2009).

Table A3.1: Summary of pedestrian dataset from OTS and police fatal files

Age group	Injury severity	Impact speed group (mph)						Total
		0–10	11–20	21–30	31–40	41–50	50+	
0–14	Fatal	0	1	4	1	3	0	9
	Serious	5	11	5	1	0	0	22
	Slight	7	15	1	0	0	0	23
	All	12	27	10	2	3	0	54
15–59	Fatal	1	2	8	5	5	9	30
	Serious	4	13	7	9	1	0	34
	Slight	3	14	8	0	0	0	25
	All	8	29	23	14	6	9	89
60+	Fatal	1	2	16	3	3	0	25
	Serious	1	5	3	1	0	0	10
	Slight	1	2	1	0	0	0	4
	All	3	9	20	4	3	0	39
Unknown	Fatal	0	0	1	0	0	1	2
	Serious	1	2	3	1	1	0	8
	Slight	0	4	1	0	0	0	5
	All	1	6	5	1	1	1	15
Total		24	71	58	21	13	10	197

Table A3.2: Summary of frontal impact dataset for belted car drivers in impacts with another car

Injury severity	Impact speed group (mph)						Total
	0–10	11–20	21–30	31–40	41–50	50+	
Fatal	0	8	16	19	14	9	66
Serious	20	140	207	94	14	3	478
Slight	36	38	2	0	0	0	76
All	56	186	225	113	28	12	620

Table A3.3: Summary of side impact dataset for belted car drivers in impacts with another car							
Injury severity	**Impact speed group (mph)**						**Total**
	0–10	**11–20**	**21–30**	**31–40**	**41–50**	**50+**	
Fatal	0	5	12	2	2	0	21
Serious	13	47	14	2	0	0	76
Slight	13	7	1	0	0	0	21
All	26	59	27	4	2	0	118

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Personalize Fuel Prices

Drive Sensibly

Aggressive driving (speeding, rapid acceleration and braking) wastes gas. It can lower your gas mileage by roughly 15% to 30% at highway speeds and 10% to 40% in stop-and-go traffic.[1,2]

Driver feedback devices can help you drive more efficiently. A recent study suggests that they can help the average driver improve fuel economy by about 3% and that those using them to save fuel can improve gas mileage by about 10%.[3]

Sensible driving is also safer for you and others, so you may save more than gas money.

Fuel Economy Benefit:	10%–40%
Equivalent Gasoline Savings:	$0.35–$1.38/gallon

Observe the Speed Limit

While each vehicle reaches its optimal fuel economy at a different speed (or range of speeds), gas mileage usually decreases rapidly at speeds above 50 mph.

You can assume that each 5 mph you drive over 50 mph is like paying an additional $0.24 per gallon for gas.[4]

Observing the speed limit is also safer.

What is the penalty for my car?

Fuel Economy Benefit:	7%–14%*
Equivalent Gasoline Savings:	$0.24–$0.48/gallon*

* Average savings, assuming drivers are willing to slow down 5 to 10 mph and fuel costs $3.46 per gallon.

Avoid Hauling Cargo on Your Roof

Hauling cargo on your roof increases aerodynamic drag (wind resistance) and lowers fuel economy.

A large, blunt roof-top cargo box, for example, can reduce fuel economy by around 2% to 8% in city driving, 6% to 17% on the highway, and 10% to 25% at Interstate speeds (65 mph to 75 mph).[5]

Rear-mount cargo boxes or trays reduce fuel economy by much less—only 1% or 2% in city driving and 1% to 5% on the highway.

If you need to use an external cargo container, removing it when it's not in use will save fuel and