Appendix B. Existing Resources and Conditions Report

MEMO

SAFE STREETS Research + Consulting

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DATE: September 24, 2024
RE: Task 3: High Injury Network and Safety Analysis – *Revised Draft*
PROJECT: BART Safety Action Plan for Roadways

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1 Introduction

Over 21,000 traffic crashes occurred within typical travel distances of BART stations (called station "catchment areas") between 2019 and 2023. Of these, nearly 1,900 crashes resulted in someone being killed or severely injured. Per passenger mile, BART is vastly safer than nearly all other forms of ground transport (driving, being driven, walking, bicycling, and rolling). Yet these statistics show that traffic safety affects BART riders at the beginning and end of their journeys as well as all other people traveling in the vicinity.

Regional transit providers like BART serve a unique role in advancing transportation safety by offering residents and visitors a safer way to travel while reducing vehicle miles traveled. Providers like BART also partner with local agencies to advance transit-oriented development, which usually entails roadway design and operations changes that improve safety for all road users.

Recognizing this important role, BART began more intentionally planning for traffic safety at and around station areas through Safe Trips to BART, a safety action plan for roadways funded through a Safer Streets and Roads for All (SS4A) grant. This groundbreaking work represents one of the first examples of a transit provider directly working toward improving safety for all road users.

This report shares results from an analysis of traffic crashes happening on BART station property and public streets in BART station catchment areas, completed as part of the Safe Trips to BART project. The analysis follows a Safe System Approach (SSA), which is built on the principle that traffic deaths and serious injuries are both unacceptable and preventable.[1] This work has the potential to be broadly impactful from a public health perspective, as system-level changes that reduce vehicle miles traveled, shape the built environment, and change roadway design and operations are more effective than strategies that rely on individual actions or decisions.[2]

The analysis results presented here satisfy the SS4A safety action plan analysis requirements by examining historical trends and existing conditions, evaluating location-specific and mode-specific risk factors for severe crash outcomes, and identifying higher-risk locations via the development of a High Injury Network (HIN). The analysis covered findings related to crashes involving pedestrians, bicyclists, motorcyclists, and motorists over a five-year period (2019-2023) using publicly available police report data and roadway data.

Through this work, BART identified four key themes about safety on public streets in BART station catchment areas:

1. **BART station areas are uniquely important to the region for traffic safety.** Streets within station catchment areas see about twice as many fatal and serious injury crashes per mile than streets in the rest of the five-county region in which BART operates.

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[1] https://highways.dot.gov/safety/zero-deaths

[2] Ederer, D. J., Panik, R. T., Botchwey, N., & Watkins, K. (2023). The Safe Systems Pyramid: a new framework for traffic safety. *Transportation research interdisciplinary perspectives*, 21, 100905.

2. **People outside the vehicle are most vulnerable to traffic crashes near BART stations, especially in more auto-oriented areas.** When a crash occurs, pedestrians and motorcyclists experience the highest risk of a severe outcome, followed by bicyclists. Under higher-risk conditions, the severity risk for people outside the vehicle increases even faster than for motorists.
3. **Speed is a common thread connecting nearly all other safety risk factors near BART stations.** Nearly half of all streets in station catchment areas with a 40-mph speed limit saw a higher concentration of fatal and serious injuries. Speed was also present in the subtext of other findings: auto-oriented station areas, arterial roadway classification, multi-lane roadways, and higher-volume roadways were all associated with a greater risk of severe crashes, and all of these factors are known to correlate with faster travel speeds.
4. **Safety patterns vary somewhat by the level of urbanization and auto orientation surrounding station areas, though the fundamental relationship between severe crashes, speed, and other factors is consistent.** For example, faster streets are associated with more severe crashes, but faster streets are more prevalent in auto-oriented station catchment areas than in more densely urbanized catchment areas.

The remainder of this report is organized as follows:

- Section 2 describes the data sources and methodology employed in this analysis.
- Section 3 presents trends and patterns in injury severity, mode-specific needs, and infrastructure risk factors for severe outcomes.
- Section 4 describes a High Injury Network (a geospatial analysis that helps identify higher-risk roads based on crash patterns) for BART station areas.
- Section 5 briefly draws conclusions and recommendations from this analysis for other elements of the Safe Trips to Bart Safety Action Plan for Roadways.

The findings from this work can inform safety efforts near BART stations in general and for specific safety improvements for high-priority locations surrounding BART stations. Station-specific safety metrics are included in Attachment A.

2 Methodology Overview and Data Inputs

The analysis approach described in this section follows a Safe System Approach (SSA), which is built on the principle that traffic deaths and serious injuries are both unacceptable and preventable (Figure 1).[3] The analysis focuses on three of the five pillars of the SSA: safe roads, safe speeds, and safe road users.

Figure 1. Principles and pillars of the Safe System Approach. Source: https://highways.dot.gov/safety/zero-deaths

The analysis also draws on the Safe System Pyramid framework, which organizes the Safe System Approach using a public health lens (Figure 2).[4] The foundation of the pyramid includes system-level changes, such as socioeconomic factors that reduce vehicle miles traveled and the provision of network-wide transit like BART. Changes to the built environment, roadway design, and roadway operations can then make roadways "self-explaining" in a way that encourages people to drive slower and safer while protecting vulnerable road users. Strategies that focus on individual behaviors and require individual effort are less effective.

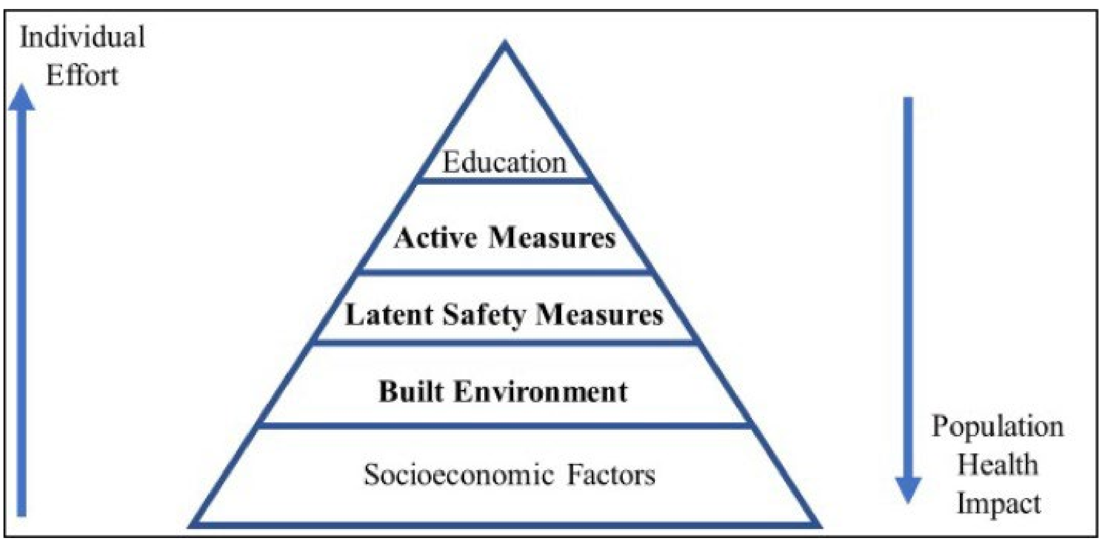

Figure 2. The Safe System Pyramid. Source: Ederer et al 2023.

[3] https://highways.dot.gov/safety/zero-deaths

[4] Ederer, D. J., Panik, R. T., Botchwey, N., & Watkins, K. (2023). The Safe Systems Pyramid: a new framework for traffic safety. *Transportation research interdisciplinary perspectives*, 21, 100905.

For these reasons, this analysis focuses on patterns and variables found closer to the bottom of the pyramid, such as land use context, socioeconomic and demographic patterns, and roadway design and operations characteristics. This analysis examined some individual behaviors as they relate to more foundational variables, such as pre-crash movements or actions that explain how different road users experience intersections and midblock locations. Variables about individual behaviors, such as speeding, alcohol, and distraction, were not included. Conclusions and recommendations drawn from this analysis prioritize strategies that benefit all road users and do not privilege the convenience of some road users over the safety of others.

2.1 Station Areas and Study Area

This analysis was completed for BART station areas and station property. Station areas were based on BART's Station Access Typology[5], which categorizes stations based on the travel modes that people typically use to access the station (see Figure 3).

Station areas for analysis were defined based on the average travel distances for people accessing BART stations across all modes, which were derived from BART's Station Profile Study[6] and measured based on actual travel distance using OpenTripPlanner[7]. Table 1 lists all five station types and the distances used in this calculation. The distance for Intermodal – Auto Reliant was also used for Auto Dependent because the Auto Dependent distance was judged to be inappropriately long for the goals of this study. The shorter distance (approximately 2 miles) concentrates emphasis on streets closer to BART stations.

Table 1. Station Area Travel Distances Based on Station Access Typology

Station Access Type	Distance
Urban	0.66 miles
Urban with Parking	0.81 miles
Balanced Intermodal	1.16 miles
Intermodal - Auto Reliant	1.96 miles
Auto Dependent	1.96 miles

The five-county BART region, including Alameda, Contra Costa, San Francisco, San Mateo, and Santa Clara counties, was selected as a broader study area for comparison with the station areas.

[5] More information about the 2015 study can be accessed here: https://www.bart.gov/about/planning/station-access/policy
[6] https://www.bart.gov/about/reports/profile
[7] Open Trip Planner documentation can be viewed here: https://docs.opentripplanner.org/en/dev-2.x/. Note that OTP routes are based on estimated travel time, which is closely correlated with distance in non-congested conditions and for people walking and bicycling, but is also affected by slope, intersections, and other factors.

Figure 3. BART's Station Access Typology. Source: https://www.bart.gov/about/planning/station-access/policy

2.2 Data Sources and Geospatial Processing

This section describes the data sources and preparation methods used to build a consolidated dataset for analysis. Data collection and consolidation bring together crashes, roadway characteristics, land use context, demographic data, and other datasets spatially so that variables can be analyzed across datasets. Data sources for this effort are listed in Table 2.

Table 2. Data sources

Data Type	Data Source
Police crash report data, including related crash, victim, and party tables	UC Berkeley's Transportation Injury Mapping System (TIMS)
Roadway geometries	OpenStreetMap
Roadway and intersection attributes (facilities and operations)	OpenStreetMap, Highway Performance Monitoring System (HPMS)
Socioeconomic and demographic information	Metropolitan Planning Commission (MTC) Equity Priority Communities, US Census Bureau

2.2.1 Crash Data

Police crash report data were retrieved for the years 2019-2023 from UC Berkeley's Transportation Injury Mapping System (TIMS). TIMS data are derived from California's Statewide Integrated Traffic Records System (SWITRS) and geo-processed by UC Berkeley. Crash reports were available for all reported crashes for all modes (pedestrian, bicyclist, motorcyclist, motorist). The TIMS database includes fatal and injury crashes only but excludes Property Damage Only ("PDO") crashes in which nobody was hurt. At the time the data were retrieved, data from 2022 and 2023 were considered provisional and not yet final.

This analysis uses the most recent five (5) years of crash data (2019—2023). Pooling data across crash years is standard to help avoid "regression to the mean" – a pattern wherein individual crash locations may move around over time quasi-randomly, but aggregated patterns over time can help reveal persistent trends. Using three to five years of data is a standard approach, and five years of data are often needed when working with pedestrian and bicyclist crash data or stratifying across crash types or geographies, as in this analysis, due to smaller sample sizes.

The data come with three sets of tables that have a relational structure: crashes, vehicles, and parties. These tables collectively describe crash-level details as well as details of individual people and vehicles (if applicable).

Crash data represent only crashes that were reported to police and for which a crash report was filed. It is well established that crashes are often under-reported – especially for lower-severity pedestrian and bicyclist crashes and in communities where trust in police officers is low. Still, crash data offer the most comprehensive source of injury data available for analysis and are, therefore, the standard practice data source for this work.

Injury Severity Assignment

Crash-level records include the severity of the most seriously injured (MSI) road user involved in the crash. Each victim involved in the crash is also assigned an individual injury severity level. In most cases, the most vulnerable road user is also the most severely injured victim involved in the crash, although drivers may sustain a more severe injury than a pedestrian or bicyclist in some cases. Using individual victim-level severity therefore helps improve the accuracy of summarizing injury severities *by mode*.

The injury severities recorded in the crash data and summarized in this analysis are defined in the California Highway Patrol Collision Investigation Manual 555 using the KABCO scale. The acronym KABCO refers to five severity levels, as follows:

- K – Killed
- A – Suspected Serious Injury (sometimes called “Injury A”)
- B – Suspected Minor Injury (sometimes called “Injury B”)
- C – Possible Injury or Complaints of Pain (sometimes called “Injury C”)
- O – Property Damage Only

Collectively, crashes in which a person was killed (K) or seriously injured (Injury A) are described as “severe” and abbreviated as “KSI” in this report. Refer to Section 2.4 for further explanation of key terms and acronyms like KSI. As mentioned earlier, the crash database used for this analysis (TIMS) does not include PDO crashes. Additionally, some of the crash severity descriptions have changed over time.[8]

Crash mode assignment

Crashes were flagged based on the involvement of any road user by mode of travel (pedestrian, bicyclist, motorcyclist, and/or motorist).

Crashes were also assigned a single mode based on the most vulnerable party involved, according to the following hierarchy:

1. Pedestrian
2. Bicyclist
3. Motorcyclist
4. Motorist

If a crash included a pedestrian and any other road user, it was classified as a pedestrian crash. Likewise, if a crash did not include a pedestrian but did include a bicyclist, it was classified as a bicyclist crash. This process was repeated throughout the hierarchy until all crashes were classified by their most vulnerable mode. This hierarchically assigned mode is used for analyses comparing crashes by crash mode.

By definition, nearly all crashes in the TIMS database involve a motorist. The label “motorist crash” as used throughout this report is based on this severity and modal assignment hierarchy even though other crashes also involved motorists. Motorcyclists are uniquely vulnerable in

[8] https://tims.berkeley.edu/help/SWITRS.php#Injury_Level

certain ways and were analyzed separately from motorists for this project. Motorcyclists are therefore not counted under the broader umbrella of "motorists" even though their mode is also motorized.

Collectively, pedestrian and bicyclist crashes are sometimes referred to as vulnerable road user (VRU) crashes. This nomenclature is consistent with the U.S. Infrastructure Investment and Job Act, which set a new requirement for state departments of transportation to conduct a Vulnerable Road User Safety Assessment (VRUSA). While it is true that people are vulnerable while walking and bicycling, their vulnerability is mainly due to sharing facilities with larger, faster vehicles like cars and trucks – not to intrinsic qualities of these modes themselves. Refer to Section 2.4 for further explanation of key terms and acronyms like VRU.

2.2.2 Roadway data

OpenStreetMap (OSM) ways and nodes were extracted for the five counties in the region using the OSMnx[9] Python package. For this analysis and HIN development, motorways (mainline freeways and limited access roads) have been removed from the network in order to focus on local traffic around BART stations, rather than through and regional traffic. On- and off-ramps have been retained.

Contextual roadway data were primarily derived from USDOT's Highway Performance Monitoring System (HPMS) data[10]. HPMS data contain variables describing roadway functional classification, posted speed limit, number of through lanes, and vehicle AADT for many (not all) streets classified as a minor collector or higher functional classification. The HPMS roadway segments were geospatially processed and joined to the regional OSM base network using a multi-stage geospatial network conflation process. Once the geospatial conflation was completed, the functional classification, posted speed limit, number of through lanes, and vehicle AADT attributes were joined to the base network.

A recursive spatial interpolation process was conducted for minor collector and higher functional class segments with NULL values for speed limit, number of lanes, and AADT using street name, functional classification, and spatial proximity. If HPMS data were not available, OSM attributes were used for posted speed limit and number of lanes to fill data gaps. Local/residential segments, which are not included in HPMS and assumed to be small, quiet streets, were assigned a static value of one lane per direction and 500 AADT.

Dual carriageways, where divided roads are digitized as two lines in the map data, were flagged via an algorithm where possible. Mileage for dual carriageways has been adjusted to reflect their overrepresentation in the data.

2.2.3 Socioeconomic and demographic data

The Metropolitan Transportation Commission (MTC) Equity Priority Communities (EPC) dataset was selected as the primary data source to examine the relationship between crashes, the High

9 Boeing, G. (2024). Modeling and Analyzing Urban Networks and Amenities with OSMnx. Working paper. https://geoffboeing.com/publications/osmnx-paper/. Tool documentation can be viewed here: https://osmnx.readthedocs.io/en/stable/
10 https://www.fhwa.dot.gov/policyinformation/hpms.cfm

Injury Network (HIN), and communities that have a significant concentration of underserved populations[11].

These data were integrated with the crash victim and party data to allow us to better understand which segments of the region's population experience a greater burden from traffic-related safety issues.

2.3 Analysis Approach

Crash report data and related roadway and contextual data were analyzed to understand patterns of crashes and common systemic factors. This analysis included victim characteristics, trends over time, severity, pre-crash movements and actions, underlying roadway and facility attributes, station access typology, and more.

The research team followed an exploratory approach to this analysis, starting with an initial list of variables of interest and then adding variables or looking at combinations of variables based on initial findings. Most variables were analyzed stratified by mode and/or station access typology to understand mode-specific needs and patterns. The numeric results were then reviewed for meaningful patterns and outputs to include in the final report.

2.4 Key Terms

Throughout the rest of this report, the following common terms and acronyms are used.

- **KSI crashes, fatal and serious injury crashes, severe crashes** – all three of these terms describe crashes in which at least one person was killed or seriously injured.
- **Non-severe crashes** – these refer to crashes in which nobody was killed or seriously injured. Someone may have sustained a minor injury or possible injury.
- **Roadway functional classification, roadway classification, functional classification, functional class, arterial functional classification** – roadway functional classification is a categorization system used to group different types of roadways by the character of service they provide and was developed for transportation planning purposes. These are often grouped into seven classifications: interstate or motorway, principal arterials and other freeways, principal arterial, minor arterial, major collector, minor collector, local. Arterial roadway classification refers to a specific type of roadway that serves a mix of local access and longer-distance through-travel. These roads often have higher speeds, more cars and trucks, and more travel lanes.
- **Vulnerable road users, people outside the vehicle** – these terms typically refer to people bicycling, walking, or using another type of personal conveyance (e.g., assistive mobility device, e-scooter, skateboard, etc.) and traveling at slower speeds. Motorcyclists and motorized scooter drivers (e.g., Vespa scooters) are typically not included in this category because they travel at the same speed as car and truck drivers, though they are also vulnerable when traffic crashes occur. Note that pedestrians' and

[11] For more information about MTC's EPC, please visit: https://mtc.ca.gov/planning/transportation/access-equity-mobility/equity-priority-communities

bicyclists' vulnerability in a crash derives from the risk posed by heavier, faster automobiles, not an inherent risk of walking or cycling.

- **Auto dependency, auto dependent, auto reliant, auto oriented** – Auto Dependent is the fifth and most auto-oriented station type within BART's Station Access Typology. Intermodal – Auto Reliant is the fourth and second-most auto-oriented station type. The terms "auto-oriented" and "auto orientation" refer more generally to areas designed primarily for vehicle throughput and are typically characterized by wider, faster streets and more plentiful parking.
- **Station Access Typology, typology, station type** – BART's Station Access Typology study classified BART stations according to their Station Access Typology. The five station types within this typology are (1) Urban, (2) Urban with Parking, (3) Balanced Intermodal, (4) Intermodal – Auto Reliant, and (5) Auto Dependent. A typology is a way of systematically categorizing things based on their attributes. A type is one of the categories within a typology. In this report, *typology* refers to the system of categorization for BART stations and *type* refers to the five individual categories within that typology.
- **Station catchment area, station area, catchment area** – These terms are used interchangeably to refer to the network-based catchment areas around BART stations based on the Station Access Typology.

3 Crash Patterns and Risk Factors

3.1 Crashes on BART Property

This brief section summarizes crashes that occurred on BART-owned property. The crash data for BART station property crashes has a different structure, variables, and level of detail than police officer crash reports for public roads. Injury severity is provided as a description of the type of injuries rather than a rating of injury severity, making comparisons between BART station property crashes and crashes on the surrounding public road network virtually impossible. Our team has attempted to guess the injury severity on the traditional KABCO scale based on the description of injury types provided, but these are an estimate and vulnerable to inaccuracies in both reporting and interpretation. Given these data limitations and the overall small number of crashes reported on BART station property, this section is brief, and the bulk of this analysis focuses on the surrounding public streets, where the vast majority of the fatalities and serious injuries near BART occur.

3.1.1 Findings

Between 2017 and 2023, nine crashes were reported on BART-owned property. Six crashes involved a pedestrian and motorist, one crash involved a bicyclist and motorist, and the remaining two crashes were motorists only. The reported injury types for each crash suggest that potentially up to eight of the nine reported crashes involved someone experiencing a suspected serious injury (Injury A), ranging from head injuries to broken bones. This may further suggest that low severity or non-injury crashes on BART station property are under-reported.

Nine reported crashes occurred at nine different stations (listed below). Four crashes occurred along access roads (three pedestrian crashes and one motorist-only crash), three occurred within or at parking garages (two pedestrian crashes and one bicyclist crash), one crash occurred at a pick-up/drop-off zone (pedestrian crash), and one crash occurred at a path (pedestrian crash). Crashes on public roads are not included in this dataset and instead are in the dataset used throughout the rest of this report.

3.1.2 List of BART Stations with a reported BART station property crash

- Pittsburgh
- West Oakland
- Pleasant Hill
- San Bruno
- Coliseum
- East Dublin
- Antioch
- Bay Fair
- Hayward

Additional details include that one fatal pedestrian occurred at the San Bruno BART station on the 4th level of the parking garage in 2018. There are few details in the data that could piece together what conditions and events contributed to this crash. The potential cause states the motorist was driving from the third floor to the fourth floor and fatally struck the pedestrian. The driver claims they did not see the pedestrian before the crash.

Five of the crashes occurred during typical peak travel periods (three crashes between 7-9 AM and 2 crashes between 4-6 PM), three occurred during the evening outside of the peak travel periods, and one occurred midday. The lighting data does not describe if streetlights were present and functional at the time the morning and evening crashes occurred. The partially complete weather condition attribute does not indicate that weather played a significant role in these crashes.

Given the aforementioned data limitations and the relative dearth of crashes on BART system property, it seems apparent that the bulk of traffic safety concerns on and near BART stations occur on public streets surrounding the station and within station catchment areas. The rest of this report focuses exclusively on crashes happening on public streets.

3.2 General Safety Patterns

This section presents some high-level findings about crash severity and how crash patterns vary across the station typology.

3.2.1 Injury Severity

During the five-year study period, there were 21,408 reported crashes in the BART station catchment areas examined for this report. Of those crashes, 1,873 crashes resulted in someone being killed or seriously injured (KSI) on the roadway – more than one person each day. The fatal and severe injury toll was highly disproportionate between different roadway users. Pedestrians, motorcyclists, and bicyclists were much more vulnerable to experiencing a fatal or serious injury if involved in a crash with a motorist when compared to crashes only involving motorists, as illustrated in Figure 4. Pedestrians comprised approximately 16% of all crashes but 32% of KSI crashes, motorcyclists accounted for 7% of all crashes but 16% of KSI crashes, and bicyclists were involved in 10% of all crashes but nearly 13% of KSI crashes.

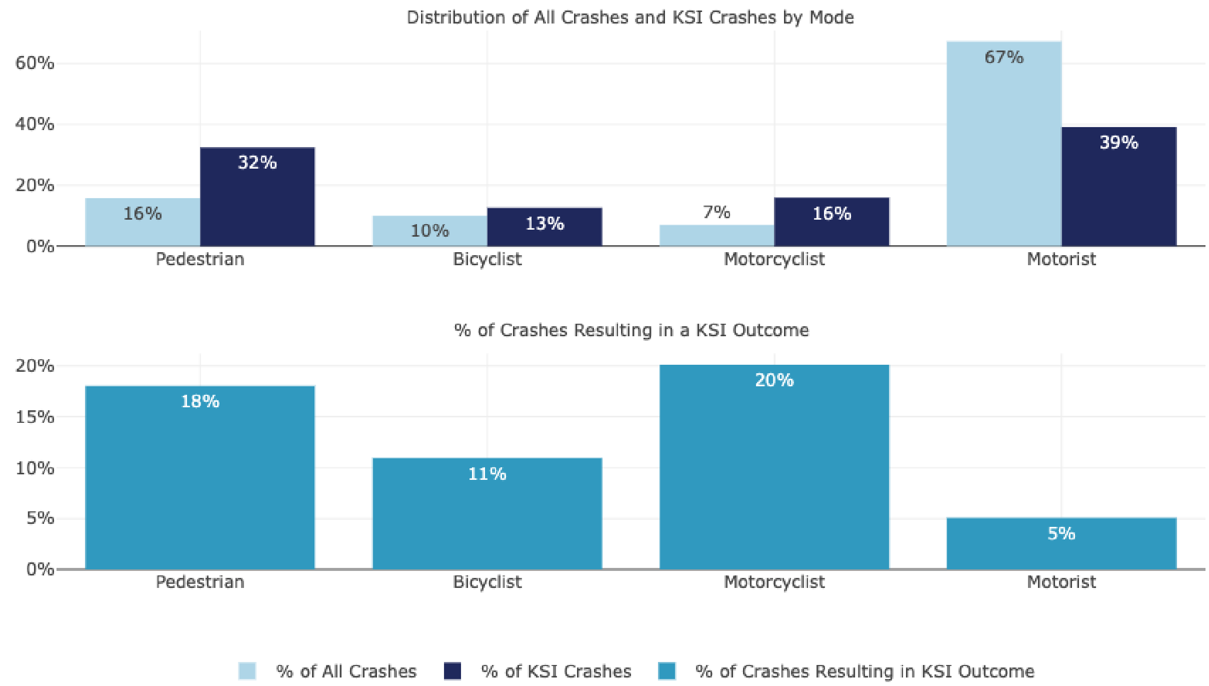

Figure 4. Distribution of Crashes and KSI crashes by Mode, 2019-2023 (excluding freeways)

3.2.2 Station Catchment Area Type

Motorcyclists were consistently the most likely to experience a severe outcome, followed closely by pedestrians as displayed in Figure 5. Bicyclists were generally about twice as likely to experience a severe outcome as motorists, but were consistently much less likely to experience a severe outcome than pedestrians or motorcyclists. Furthermore, crash severity for both pedestrians and motorcyclists consistently increased as station areas become more auto-oriented, culminating in their being approximately twice as likely to have experienced a severe outcome in Auto Dependent station catchment areas as in Urban station areas.

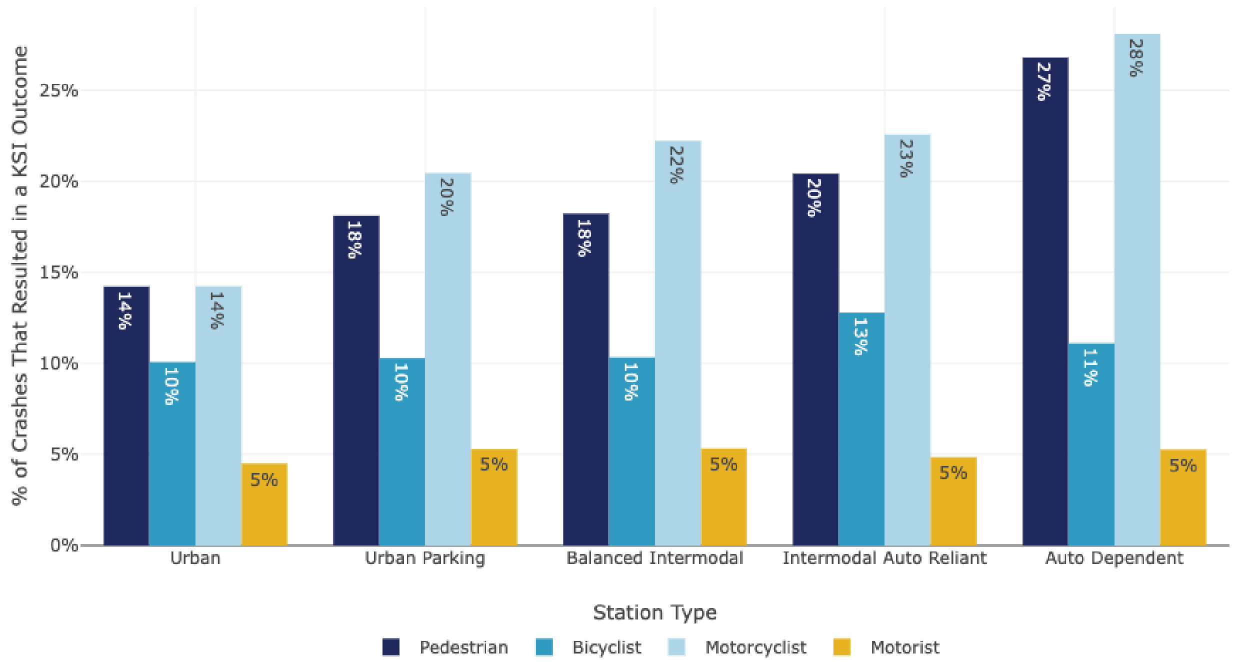

Figure 5. Percentage of Crashes Resulting in a KSI Outcome by Mode and Station Type, 2019-2023 (excluding freeways)

3.3 Systemic Safety Patterns

This section summarizes crash patterns as they relate to known modifiable risk factors that were present in the data. The analysis focused on three main categories:

- Infrastructure-related risk factors (speed, lanes, lighting, etc.),
- Transit stops (bus stops) as a proxy for high exposure, and
- Equity and sociodemographic variables to understand the inequitable burden of traffic crashes on disadvantaged communities.

Each section in this chapter presents 1-2 overall takeaways where appropriate, followed by key findings by mode.

Table 3 shows variables that were associated with injury severity across the various station types. Darker colors indicate a stronger association with injury severity within a station catchment area compared to other risk factors in that area. Some risk factors are not as applicable to certain station types (e.g., 35 mph posted speed limits were limited in urban station areas) and have a weaker association. Location type risk factors are stronger or weaker compared to other values in that particular category – e.g., signalized intersections have a stronger association with KSIs than unsignalized intersections in urban areas, but are much less likely to be associated with KSIs in balanced intermodal and auto-dependent areas.

Table 3. Risk Factors by Station Typology, All Modes, 2019-2023 (excluding freeways)

Risk Factor	Station Typology

	Urban	Urban Parking	Balanced Intermodal	Intermodal Auto-Reliant	Auto Dependent
Modifiable Roadway Design & Operational Factors					
Arterial classification	88%	82%	68%	68%	62%
4+ Lanes	46%	57%	49%	52%	50%
Posted speed ≥ 35 mph	15%	22%	52%	70%	74%
Proximity to transit stops	35%	10%	5%	2%	0%
Location Type Factors					
Midblock	17%	14%	18%	28%	29%
Signalized Intersection	64%	41%	23%	28%	11%
Unsignalized Intersection	20%	44%	59%	44%	60%
Equity Factors					
Equity Priority Areas	66%	34%	78%	35%	27%
Environmental Factors					
Darkness	41%	46%	51%	43%	46%

Legend:				
	Very Strong Association (> 50%)	Strong Association (25 to 49%)	Moderate Association (15 to 24%)	Low Association (< 15%)

3.3.1 Lighting Condition

Crashes were more likely during the daytime than in dark or low-light conditions, which likely reflects travel volumes throughout the day, but average crash severity was consistently higher for crashes that occurred in dark conditions for all modes (see Figure 6). For example, pedestrian crashes in darkness were approximately twice as likely to be severe as pedestrian crashes in daylight (25% compared to 13%, respectively).

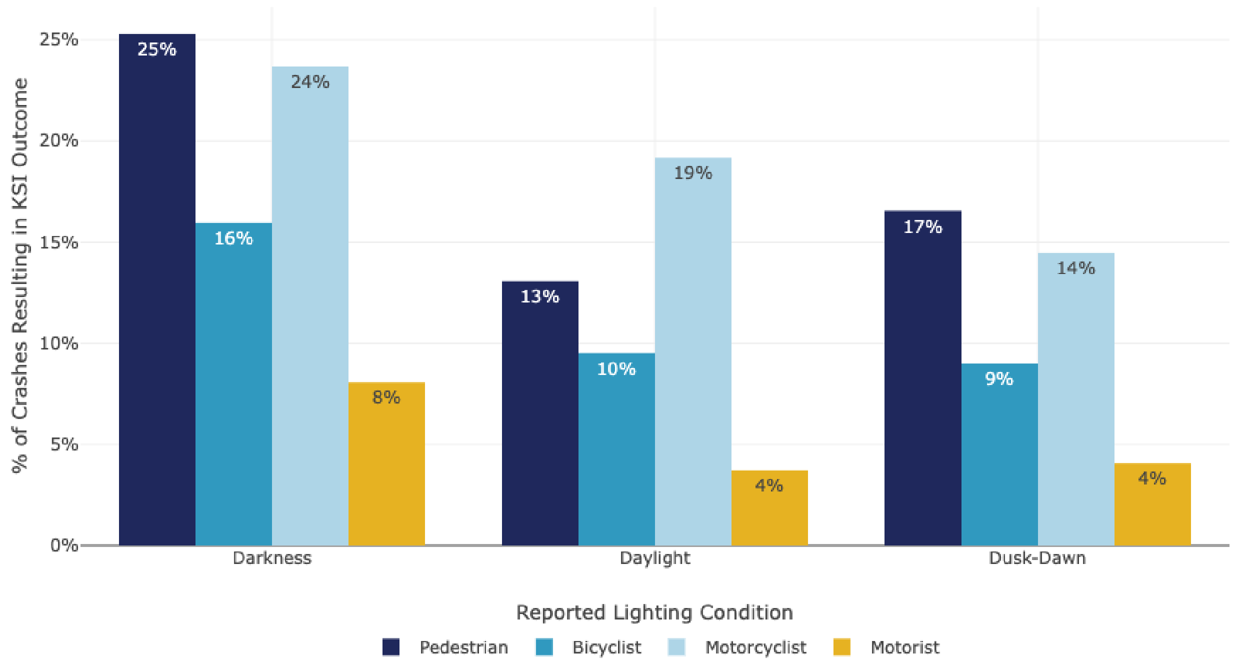

Figure 6. Percentage of Crashes Resulting in a KSI Outcome by Mode and Lighting Condition, 2019-2023 (excluding freeways and unknown lighting conditions)

While all modes experienced a higher proportion of crashes resulting in a fatality or serious injury during darkness, pedestrians and motorcyclists were particularly vulnerable in darkness than in daylight conditions. The combination of darkness and auto-orientation was particularly risky for both of these modes: pedestrian crashes in darkness in Auto station areas were more than twice as likely to be severe as those in Urban station areas (see Table 4), and nearly twice as likely for motorcyclists in the same circumstances. Bicyclists appear to have been at greater risk of a severe outcome in Balanced and Intermodal station areas in darkness than in other area types.

For all modes, the percentage of KSI outcomes during dark lighting conditions was lowest near Urban stations, which may indicate some neutralizing effect due to a combination of roadway design and street lighting in those areas relative to other areas.

Table 4. Percentage of Crashes Resulting in a KSI Outcome During Dark Lighting Conditions, by Mode and Station Type, 2019-2023 (excluding freeways)

Mode	Station Typology				
	Urban	Urban Parking	Balanced Intermodal	Intermodal Auto-Reliant	Auto Dependent
Pedestrian	17%	28%	26%	29%	40%
Bicyclist	13%	18%	20%	21%	13%
Motorcyclist	15%	29%	28%	27%	26%
Motorist	6%	7%	9%	8%	9%

3.3.2 Location Type

Table 5 shows what percentage of KSI crashes happen at each of three location types – midblock locations, signalized intersections, and unsignalized intersections – by mode and station access type. For each mode and station access type, the largest value is emphasized using **magenta** text. Across each mode, these magenta cells show a pattern across the urban to auto dependent gradient. In urban station catchment areas (and urban parking for pedestrians), most crashes happen at signalized intersections. With increasing auto orientation, the predominant location type shifts to unsignalized intersections. This reflects the underlying fabric of the built environment in more auto-oriented areas; the distance between signalized intersections is longer, and unsignalized intersections along suburban arterials increase in their relative risk.

Table 5. Percentage of KSI Crashes within Each Station Catchment Area by Mode and Location Type, 2019-2023 (excluding freeways)

Mode	Location Type	Station Typology				
		Urban	Urban Parking	Balanced Intermodal	Intermodal Auto-Reliant	Auto Dependent
Pedestrian	Midblock	14%	12%	16%	27%	32%
	Signalized Intersection	**67%**	**48%**	24%	28%	5%
	Unsignalized Intersection	19%	40%	60%	45%	62%
Bicyclist	Midblock	17%	25%	20%	28%	24%
	Signalized Intersection	**67%**	22%	27%	24%	9.50%
	Unsignalized Intersection	16%	**53%**	**54%**	**48%**	**67%**
Motorcyclist	Midblock	16%	11%	15%	28%	32%
	Signalized Intersection	**56%**	43%	22%	28%	16%
	Unsignalized Intersection	28%	**46%**	**64%**	**44%**	**52%**
Motorist	Midblock	20%	12%	20%	29%	27%
	Signalized Intersection	**61%**	43%	22%	28%	12%
	Unsignalized Intersection	19%	**45%**	**57%**	**43%**	**62%**

Midblock crashes are less common than intersection crashes in BART station catchment areas, and this is particularly true toward the urban end of the typology. Intermodal – Auto Reliant and Auto Dependent station types see the highest percentages of midblock crashes for all modes. This is likely attributable to the same factors as the increasing prevalence of unsignalized intersection crashes at the auto-oriented end of the typology. Longer blocks and greater distances between signalized intersections lead to higher speeds and fewer pedestrian crossing opportunities.

3.3.3 Roadway Functional Classification[12]

Local streets account for the largest share of network mileage within the station catchment areas (about 55% of the network mileage). While these streets account for most of the network, only about 7% of crashes and KSI crashes occurred along these streets, resulting in a very low concentration of crashes (0.9) and KSI crashes (0.1) per mile. Conversely, principal arterials had the largest share of crashes (47%) and KSI crashes (46%) while representing less than 13% of the network. For all station types, principal arterials accounted for the largest share of all crashes and KSI crashes, as shown in Figure 7.

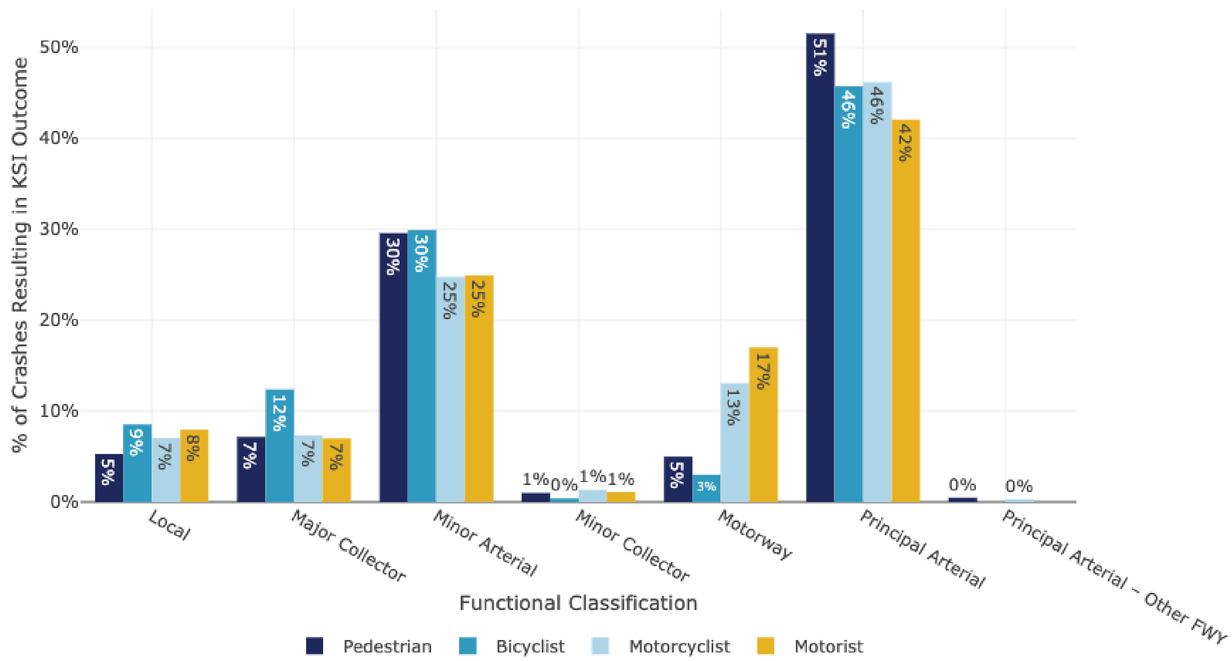

Figure 7. Distribution of KSI Crashes by Functional Classification, All Modes, 2019-2023 (excluding freeways)

Minor arterials had the second largest share of crashes and KSI crashes for all station types except Auto stations, for which interstates (or motorways) accounted for the second largest share of all crashes and tied with minor arterials for the second highest percentage of KSI crashes. These findings are consistent with national research about the overrepresentation of arterials among pedestrian fatality hotspots.[13]

12 Refer to section 2.4 for more information about roadway functional classification.

13 Schneider, R. J., Sanders, R., Proulx, F., & Moayyed, H. (2021). United States fatal pedestrian crash hot spot locations and characteristics. Journal of Transport and Land Use, 14(1), 1–23. https://doi.org/10.5198/jtlu.2021.1825

The proportion of crashes that resulted in a KSI outcome did not vary substantially between the different functional classifications across the different station types.

3.3.4 Posted Speed Limit[14]

Most of the street network (67%) has a posted speed limit of 25 mph. While the *highest frequency* of crashes (39%) and KSI crashes (41%) occurred on these 25-mph roadways, they also had the *lowest concentration* of crashes and KSI crashes on a per-mile basis. Streets with a posted speed limit of 45+ mph had the second-highest share of crashes (24%) and KSI crashes (23%) while representing only 11% of the network mileage. Figure 8 shows the percentage of crashes by mode and posted speed limit.

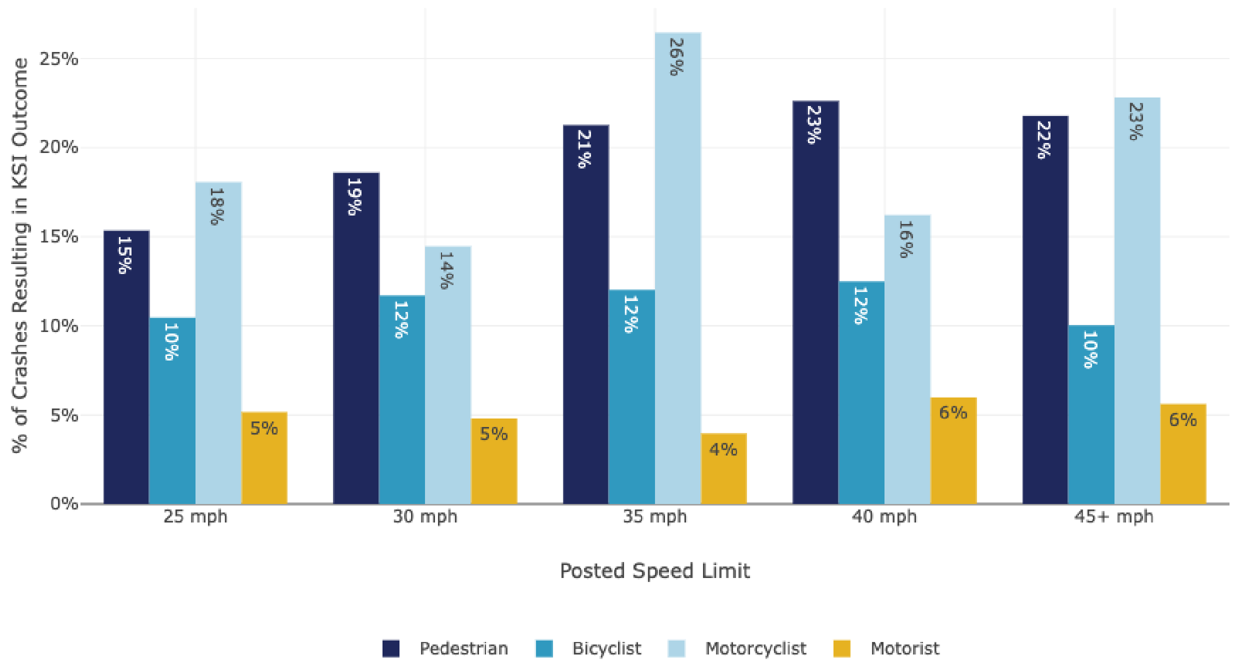

Figure 8. Percentage of Crashes Resulting in a KSI Outcome by Posted Speed Limit, All Modes, 2019-2023 (excluding freeways)

There are differences in terms of the street types where the crashes occur, which likely reflect the underlying network fabric. The vast majority of crashes and KSI crashes in Urban station areas occur on 25-mph streets, which comprise the largest share of the network in those areas. As street mileage associated with higher speeds increases in other areas (i.e., more auto-oriented stations), the percentage of crashes and KSI crashes along those higher-speed streets increases. Furthermore, higher-speed streets had higher proportions of crashes resulting in a KSI outcome for pedestrians and motorcyclists (and to a lesser degree, bicyclists) compared to lower-speed streets. This finding is consistent with these modes being at higher risk near more auto-oriented stations, which have a larger proportion of the network signed at higher speeds

[14] Note that the posted speed limit reflects the law but not the actual speed of the roadway users (prevailing speed). While not a perfect replacement, posted speed limits are commonly used to represent speed in the absence of prevailing speed data.

and often lack safe and convenient pedestrian infrastructure within the station catchment areas.

3.3.5 Number of Lanes

Crashes and KSI crashes were concentrated on 2-lane and 4-lane roadways across all station area types for each mode. When looking at the proportion of crashes resulting in a KSI outcome regardless of the station catchment area type, the proportions are nearly the same at 2-lane and 4-lane roadways, but notably higher for pedestrians, bicyclists, and motorcyclists along 5-lane roads and for pedestrians along 6-lane roads (see Figure 9).

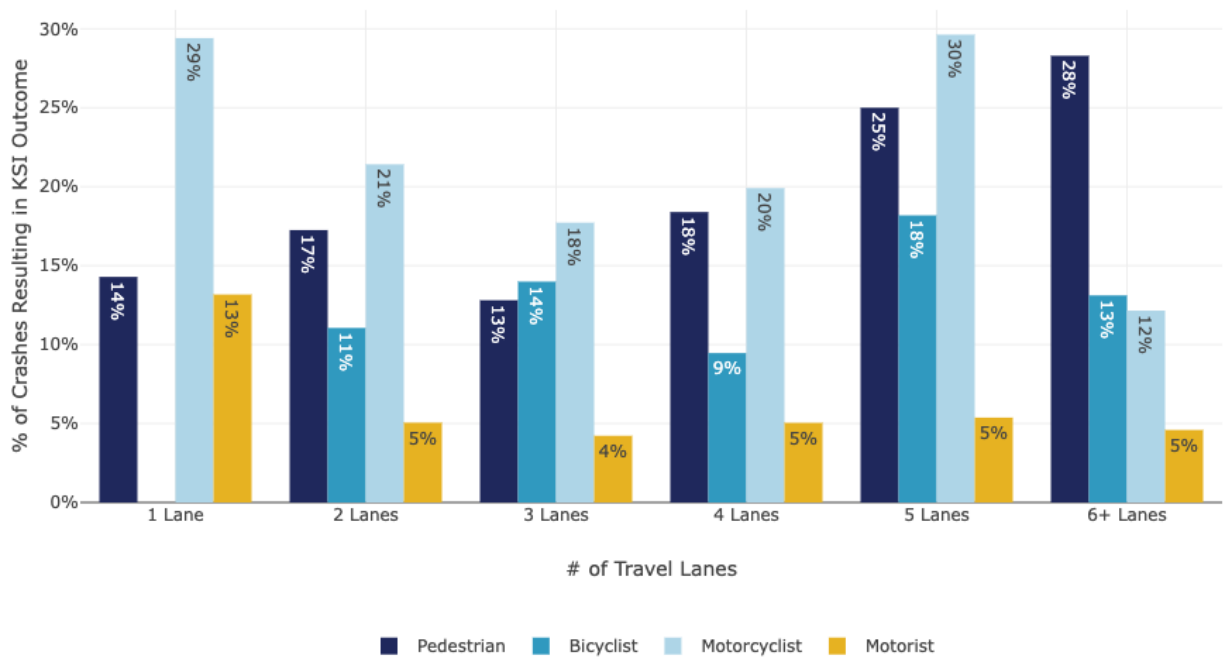

Figure 9. Percentage of Crashes Resulting in a KSI Outcome by Number of Travel Lanes, All Modes, 2019-2023 (excluding freeways)

Table 6 shows the percentage of KSI crashes that occurred along 4+ lane roads by mode and station area type, along with Table 6the percentage of the street network within each station catchment area that has 4+ lanes. A large percentage of KSI crashes for each mode occurred along 4+ lane roads despite the relatively low percentage of network mileage, underscoring the important role these roadways play in the safety all roadway users across the region.

Table 6. Percentage of KSI Crashes Along 4+ Lane Roads by Mode and Station Type, 2019-2023 (excluding freeways)

Mode	Station Typology				
	Urban	Urban Parking	Balanced Intermodal	Intermodal Auto-Reliant	Auto Dependent
Pedestrian	47%	56%	47%	55%	46%
Bicyclist	48%	50%	44%	39%	24%
Motorcyclist	50%	51%	53%	53%	52%
Motorist	42%	64%	49%	52%	57%
Street Mileage	20%	14%	17%	14%	12%

3.3.6 Vehicle Volume

More urbanized station areas tend to have a lower proportion of severe crashes at lower vehicle volumes, while more auto-oriented station areas show the reverse trend. This finding may reflect the greater overall modal activity in more urban areas, which can have a traffic calming influence compared to emptier roads. These trends are also inseparable from speed limits and roadway design, which significantly influence behavior.

In Urban and Urban Parking station areas, pedestrian and bicyclist crashes on the lowest-volume roads (0-7500 AADT) were more than half as likely to be severe as crashes on those same roads in Auto station areas. In contrast, pedestrian and bicyclist crashes on the highest volume roadways (> 25,000 AADT) were more likely to experience a severe outcome in Urban areas (about 22%) compared to Auto areas (about 13%, small sample size).

A notable proportion of motorcyclist crashes was severe on even the lowest-volume roads (0-7500 AADT), ranging from 18% in Urban station areas to 29% in Auto station areas. In Auto station areas, motorcyclist crashes ranged from 27% severe on roadways with > 25,000 AADT to 33% severe on roadways with 15,001 - 25,000 AADT. Motorist crash trends are similar to those observed for motorcyclists, but with a *much* lower likelihood of a severe outcome in all cases

3.3.7 Transit Stops (bus stops)

In Urban station catchment areas, about one third of all severe crashes happen near a transit stop (ranging from 29 to 37 percent by mode), as shown in Table 7. This correlation between transit and crashes likely reflects higher exposure and activity around transit stops, particularly for pedestrians. The percentage of severe crashes that happened near transit decreased with increased auto orientation for all modes, with almost none of the severe crashes in Auto Dependent station catchment areas happening at transit stops. This may reflect the density and availability of transit stops at the Urban end of the Station Access Typology.

Table 7. Percent of KSI crashes Near a Transit Stop Within Each Station Catchment Area Type by Mode, 2019-2023 (excluding freeways)

Mode	Station Typology

	Urban	Urban Parking	Balanced Intermodal	Intermodal Auto-Reliant	Auto Dependent
Pedestrian	37%	10%	7%	2%	0%
Bicyclist	35%	9%	2%	0%	0%
Motorcyclist	29%	0%	3%	3%	0%
Motorist	36%	15%	5%	2%	0%

3.3.8 Equity Priority Communities

The proportions of crashes and KSI crashes were much larger within Equity Priority Communities (EPC) areas than non-EPC areas for Urban and Balanced station areas, but much lower within EPC areas for Urban Parking, Intermodal, and Auto station areas. Urban and Balanced stations are the only two station types that have the majority of their street networks within an EPC. For Urban and Urban Parking station areas, crashes within EPC areas were less severe on average than those in non-EPC areas. However, percentages were close across all areas except Urban Parking, in which 6.9% of crashes within EPC areas were severe, compared to 11.3% in non-EPC areas.

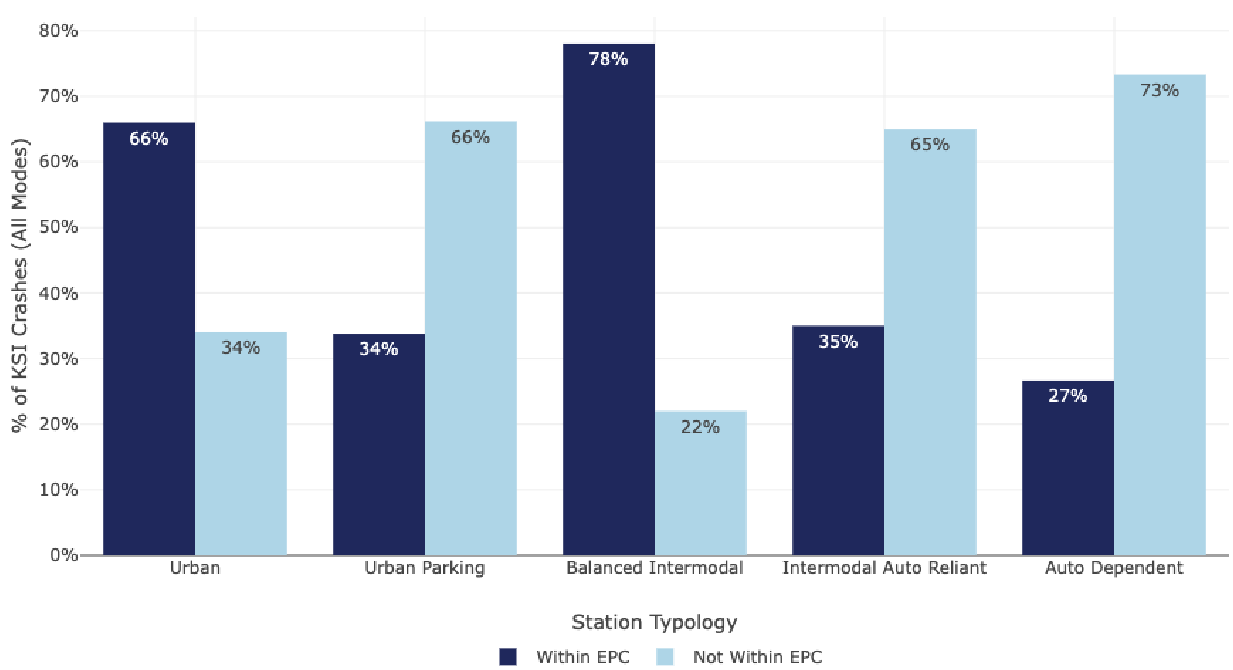

Figure 10. Distribution of KSI crashes Within Each Station Type by Proximity to Equity Priority Communities, All Modes, 2019-2023 (excluding freeways)

4 High Injury Network

4.1 Methodology

BART's High Injury Network (HIN) was developed to identify spatial clusters of fatal and injury crashes based on crash history. The HIN prioritizes areas where the greatest concentrations of fatal and serious injury crashes happen, in line with the Safe System Approach. This type of analysis is semi-reactive since it is based primarily on crash history. However, the process of identifying entire corridors allows for some proactive or systemic recommendations to emerge.

The primary input in the development of the HIN was the crash database previously described in Section 2.2.1. The HIN is primarily informed by fatal and serious injury crashes (collectively called severe crashes) for all modes. Many other agencies' HINs also include minor injury crashes for pedestrians, bicyclists, and motorcyclists because these crashes are relatively fewer in number than motorist-only crashes and yet are much more severe on average than motorist-only crashes. In the five-county region in which BART operates, four of the five counties benefitted from including these lower frequency minor injury crashes. In San Francisco County, the crash density for all modes was so high that minor injury crashes were not needed to help with pattern detection. When included, minor injury crashes were weighted less than fatal and serious injury crashes with a 3:1 ratio. This weighting is consistent with many Vision Zero safety analyses.

BART's HIN was built using a process called sliding windows analysis. This analysis helps detect patterns of crashes happening in sequence. First, the analysis calculates the weighted score for crashes happening along a one-mile virtual "window" of the road network. Then, the window is moved one-tenth of a mile (0.1 mile) along the network, and the score is calculated again. Figure 13 illustrates this virtual window stepping along a street with crash scores calculated at each step.

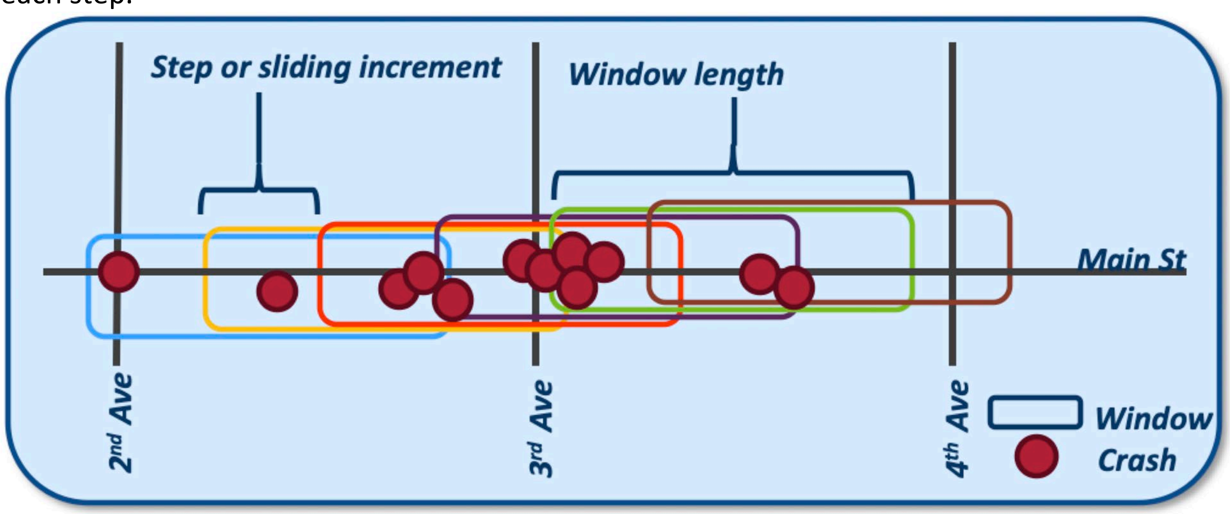

Figure 11. Sliding windows process to measure crashes in window segments along a network.

This process was repeated across the 5-county regional street network for each mode separately, and then again for all modes combined. Restricted access freeways were excluded from the analysis, though freeway access ramps were retained. The resulting output was a linear density of fatal and injury crashes (per the weighting above) for each mode and for all modes combined.

Once the sliding windows analysis had been run for the entire road network (excluding restricted-access freeways) for each mode, the weighted crash scores on the network were analyzed. Thresholds were chosen to categorize the network into higher-scoring segments that are on the HIN and lower-scoring segments that are not on the HIN. Threshold selection was informed by HIN performance metrics, desired HIN size (i.e., how many miles), agency goals, and professional judgment. In this analysis, separate thresholds were selected for San Francisco County compared to the other four counties combined due to the overall higher density of severe crashes for all modes in San Francisco County.

The inclusion of mode-specific scoring and thresholds ensures that the HIN represents mode-specific needs. At the same time, the inclusion of all modes combined ensures that the HIN does not miss locations with a history of many severe crashes that happened to different modes such that no single mode exceeded the modal threshold. The all-modes threshold was defined as the sum of the two lowest modal thresholds.

Table 8. Severity-weighted crash score thresholds used to build BART's High Injury Network.

Modal Network	Thresholds in Alameda, Contra Costa, San Mateo, and Santa Clara Counties	Thresholds in San Francisco County
Pedestrian	8	12
Bicyclist	7	9
Motorcyclist	7	9
Motorist	9	9
All Modes Combined	14	18

The HIN was built by selecting all segments that exceed at least one of these thresholds. For example, if a segment in Alameda County had a pedestrian score of 9, it became part of the HIN irrespective of its other scores. If none of the mode-specific scores exceeded the modal thresholds but the all-modes score combined exceeded the fifth threshold, the segment was also classified as being on the HIN. For example, if a segment in San Francisco County had two severe crashes for each mode, no single modal score would exceed the modal thresholds of 9 and 12. However, the combined all-modes score would be 24, which exceeds the threshold of 18 and qualifies the segment for the HIN.

After thresholds were selected and applied to define the HIN, the HIN was filtered to include only segments in BART station areas (as described in Section 2.1).

4.2 HIN Results

As Figure 14 shows, over three-quarters of severe crashes in BART station catchment areas happen on just 18% of the street miles. Along the HIN, severe crashes happen with a density of 2.8 severe crashes per mile over five years, shown in Table 9. By contrast, the remaining 82% of the street network in station catchment areas covers only 24% of severe crashes, at a density of about 0.2 per mile. In other words, these 508 miles of streets that comprise the HIN are disproportionately prone to severe crashes and can benefit from safety improvements that reduce the likelihood and severity of traffic crashes for all road users, including people accessing BART stations.

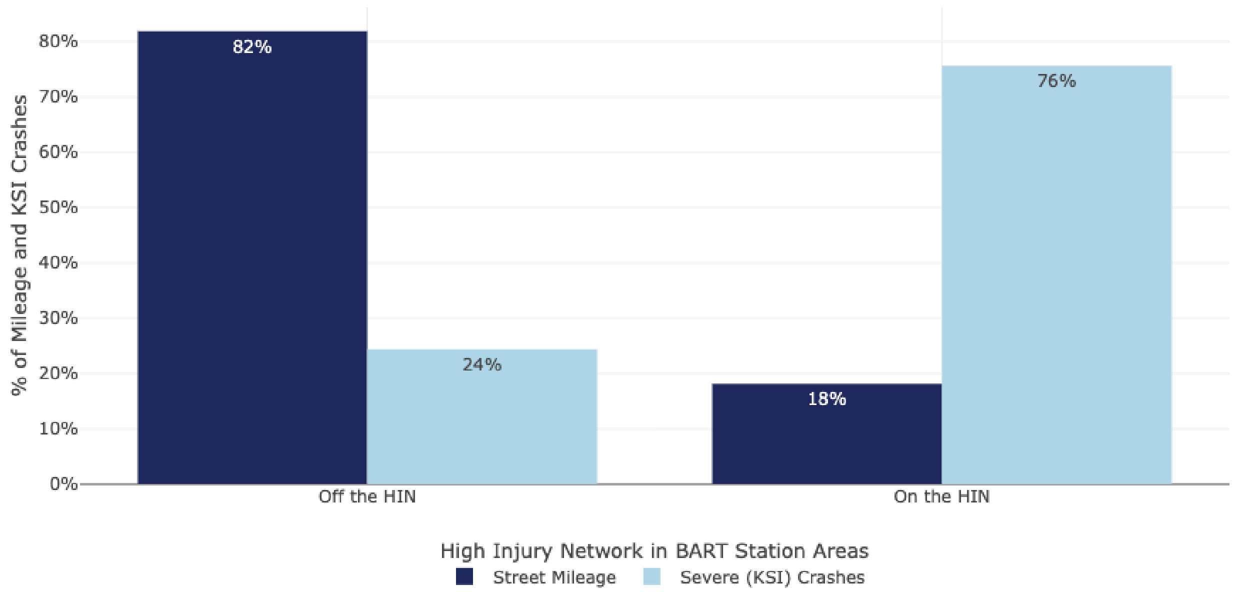

Figure 12. Mileage and severe crashes on and off the High Injury Network.

Station catchment areas have a higher proportion of HIN miles than the five-county region at large. The 2,801 miles of roadway within station catchment areas represent only about 14% of the region's roads, and yet 31% of the streets classified as HIN fall within catchment areas. This finding underscores the importance of the concentrated activity centers around BART stations for safety improvements.

Table 9. HIN crash capture rate within BART station catchment areas, 2019-2023, excluding freeways.

HIN	# Miles	% Miles	# Crashes	% Crashes	# KSI Crashes	% KSI	KSI Crashes Per Mile
No	2,293	82%	6,085	28%	457	24%	0.2
Yes	508	18%	15,323	72%	1,416	76%	2.8
Total	**2,801**	**100%**	**21,408**	**100%**	**1,873**	**100%**	**0.7**

Figure 15 shows the HIN in station catchment areas for the whole system. Nearly every station had at least one segment on the HIN. The station-level safety metrics table in Attachment A summarizes HIN miles by station catchment area.

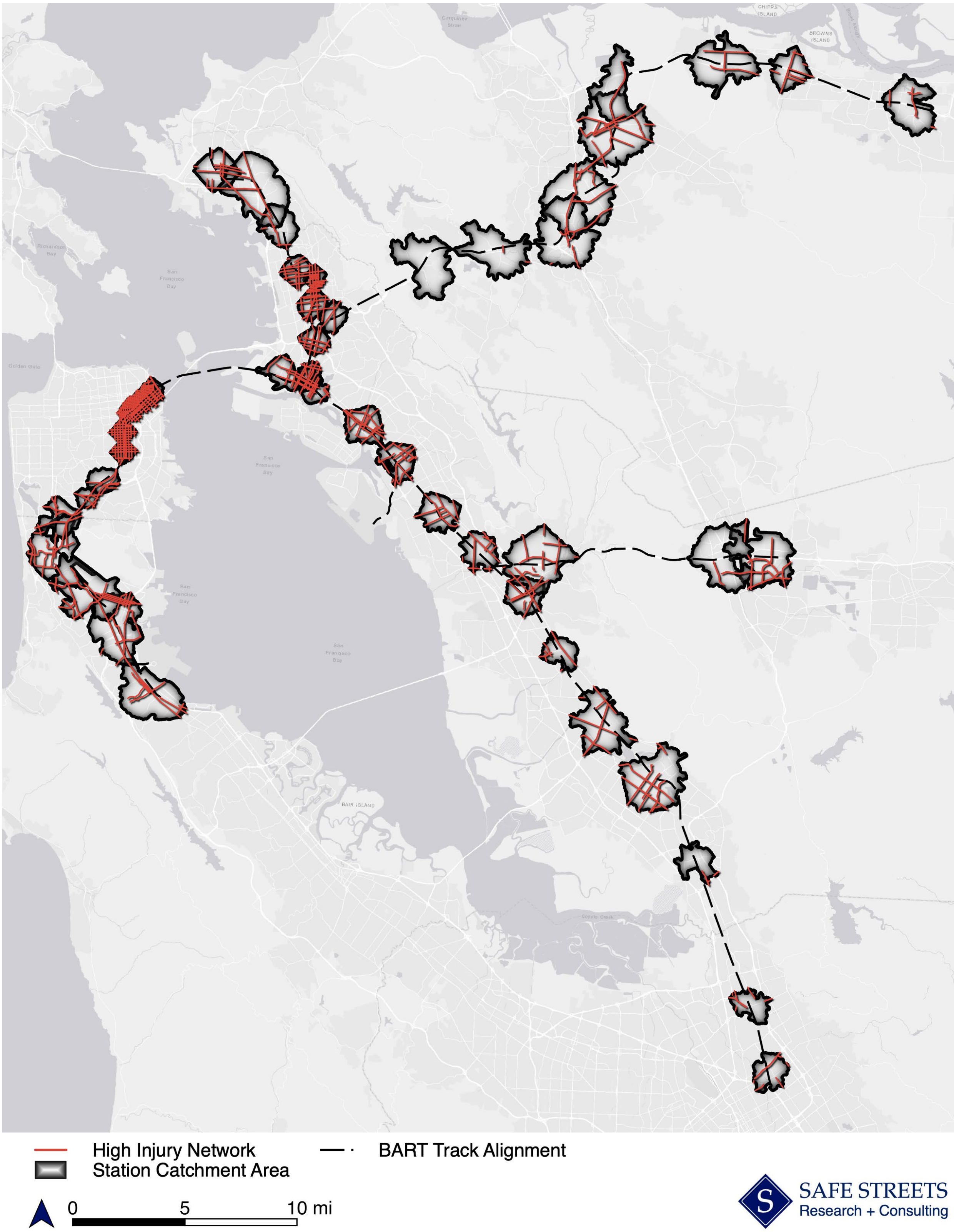

Figure 13. Map of HIN for all BART station areas.

4.3 Risk Factors along the HIN

An analysis of the HIN itself and crashes happening along it confirms many of the systemic findings already shown in Section 3.3. Pedestrians comprise the largest proportion of KSI crashes on the HIN (36%) and had the largest proportion of the mode's KSI crashes captured by the HIN (83%). Arterials, faster streets, and multi-lane streets were all overrepresented on the HIN relative to their distribution across the network within station catchment areas.

Figure 16 shows that arterial roadways (both principal and minor) comprise nearly 85 percent of the HIN, and yet these streets comprise only 15 percent of non-HIN streets. Similarly, the majority of non-HIN streets are local or residential streets (71%), yet only six percent of the HIN is classified as local.

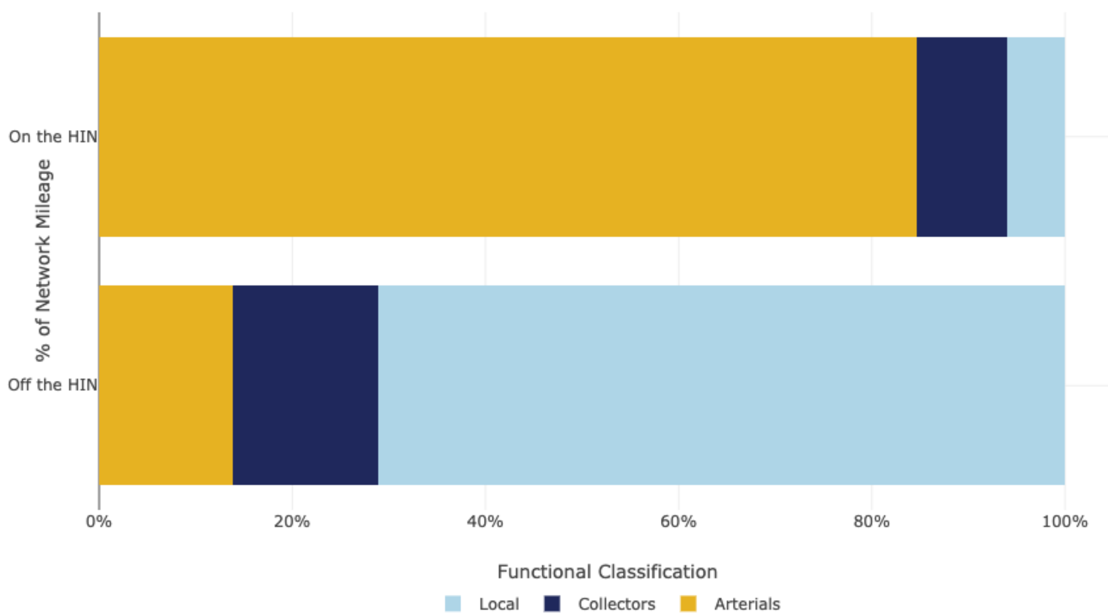

Figure 14. Percentage of street miles on and off the HIN by roadway functional classification, showing the over-representation of arterials.

Likewise, Figure 17 and Figure 18 echo the same pattern for posted speed limit and number of lanes. Faster, wider streets that were associated with severe crashes in Section 3.3 were also overrepresented on the HIN relative to the rest of the street network in catchment areas.

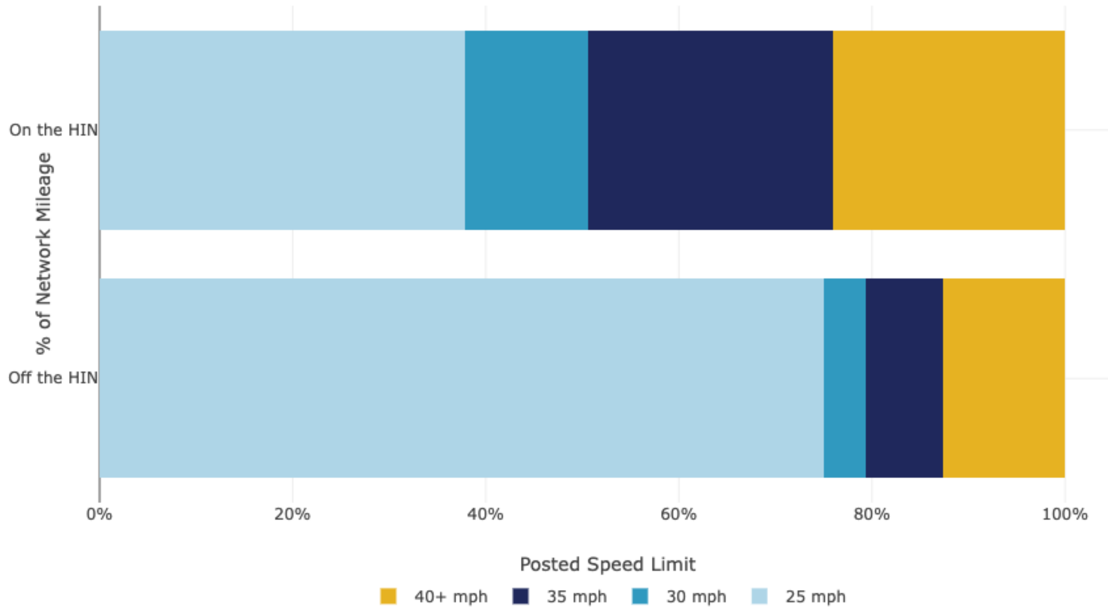

Figure 15. Percentage of street miles on and off the HIN by posted speed limit, showing the over-representation of moderate and higher speed limits

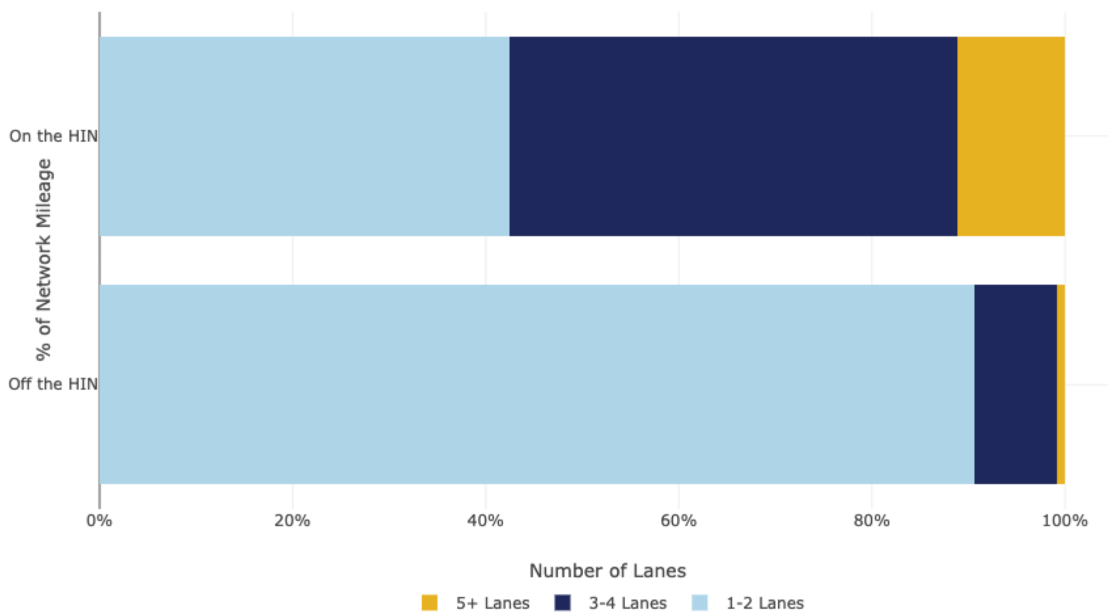

Figure 16. Percentage of street miles on and off the HIN by number of through lanes, showing the over-representation of 3-4 lane and 5+ lane roadways

The HIN captures severe crash risk better at signalized intersections than at unsignalized intersections and midblock locations. Table 10 summarizes crashes on the HIN and off the HIN by location type. While the HIN captures about 76% of all KSI crashes within the station catchment areas, it captures 96% of KSI crashes that occurred at signalized intersections, compared to only 69% of KSI crashes at unsignalized intersections and 57% of KSI crashes at midblock locations. This pattern may reflect higher exposure at signalized intersections where people are expected to cross the street and interactions between modes are high. This pattern is also consistent with other findings related to the overrepresentation of arterials on the HIN, as signalized intersections typically control arterial and/or collector roadways.

Severe crashes at unsignalized intersections and midblock locations tend to be more spread out and, therefore, are less likely to be captured by a method that measures linear clustering like the HIN. This means that midblock and unsignalized intersection crashes are somewhat less likely to be addressed if countermeasures are exclusively concentrated on the HIN. Systemically targeting unsignalized intersection and midblock locations beyond the HIN that exhibit other risk factors evident in this report (e.g., 35+ mph speed limits, 4+ lanes, 7,501+ AADT), particularly where these locations are co-located with higher exposure volumes (e.g., housing complexes, transit, or grocery and convenience stores) may help address these other crashes.

Table 10. KSI Crashes along the HIN by Location Type, All Modes, 2019-2023, excluding freeways

Location Type	Crashes on the HIN				Crashes off the HIN			
	N	% by Location Type	% within Location Type on HIN	% Resulted in KSI	N	% by Location Type	% within Location Type off HIN	% Resulted in KSI
Midblock	229	16.2%	56.7%	11.4%	175	38.5%	43.3%	10.0%
Signalized Intersection	630	44.5%	96.3%	8.3%	24	5.3%	3.7%	3.5%
Unsignalized Intersection	557	39.3%	68.5%	9.8%	256	56.3%	31.5%	7.0%
Total	**1,416**	**100.0%**	**75.7%**	**9.2%**	**455**	**100.0%**	**24.3%**	**7.5%**

4.4 Equity and the HIN

The HIN is highly overrepresented in Equity Priority Communities (EPCs), as shown in Figure 19. Miles of HIN are roughly equally split between EPCs and non-EPCs, but because EPCs comprise a much smaller share of the overall street network, the proportion of streets on the HIN (vs. off the HIN) within EPC station areas is much higher than in non-EPC areas. Only 27% of all road miles in station areas fall within EPCs, but 48% of the station area's HIN mileage falls within EPCs.

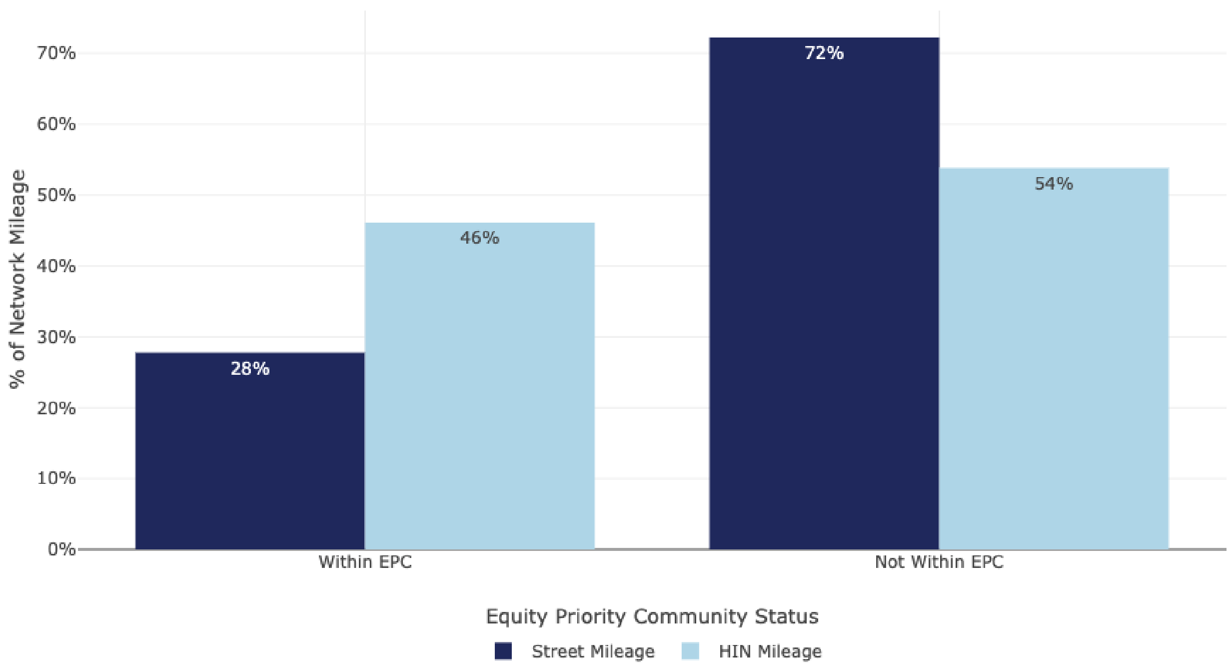

Figure 17. HIN and Street Network Mileage Within BART Station Catchment Areas by Equity Priority Community Status, 2019-2023, Excluding Freeway Segments

5 Conclusions

The findings presented in this memo describe the state of traffic safety in BART station catchment areas for all road users based on an exploratory analysis of police traffic crash reports from 2019 to 2023. The data show patterns of speed and speed-related roadway risk factors that increase the frequency and severity of crashes, particularly for people walking, bicycling, or riding a motorcycle.

The risk factors identified through this analysis are consistent with well-established risk factors for crash severity, even as the prevalence of risk factors varies by station access typology. These findings suggest that many of the same types of safety countermeasures (e.g., to reduce vehicle speed or provide additional pedestrian protection) could work across the entire BART system, with an understanding that specific countermeasures should be selected based on project context. These findings also align with safety countermeasure guidance, such as the Safe System Road Design Hierarchy, which prioritizes physical changes to the road system that remove high-risk conflicts and reduce vehicle speeds.

5.1 Limitations

The analysis had some limitations. First, without exposure data for pedestrians and bicyclists, it is impossible to normalize crashes by pedestrian or bicyclist volumes. A lack of severe crashes in an area does not necessarily mean that the area is safe. Perceptions of safety and danger affect where many people choose to walk and bicycle, which in turn affects their exposure to crash risk.

Second, crash data are the best data source available for understanding traffic safety conditions. Yet underreporting of crashes, particularly pedestrian and bicyclist crashes and particularly in lower income and communities of color, is relatively common.

Third, the HIN does a better job of capturing some types of severe crashes than others. Signalized intersection crashes are largely concentrated on the HIN, but risky areas for midblock crashes and unsignalized arterial intersection crashes may not be as well represented. Systemically targeting unsignalized intersection and midblock locations beyond the HIN that exhibit other risk factors evident in this report (e.g., 35+ mph speed limits, 4+ lanes, 7,501+ AADT), particularly where these locations are co-located with higher exposure volumes (e.g., housing complexes, transit, or grocery and convenience stores) may help address these other crashes.

Finally, some of the crash report variables are vulnerable to inaccurate or imprecise coding, and some of the. underlying roadway data may be out of date. Pooling crash data across years and across geographies, as was done in this analysis, helps mitigate data accuracy issues, as meaningful signal patterns are still evident even in noisy data.

Attachment A: Safety Metrics by BART Station Area

Table 11. Safety Metrics by Station, 2019-2023 (excluding freeways)

Station Name	# Crashes	# KSI Crashes	% Crashes Resulting in KSI	Street Mileage	HIN Mileage	% of Street Mileage along HIN	Street Mileage in EPC	% of Street Mileage within EPC
12th/Oakland	721	39	5%	32	12	39%	28	87%
16th/Mission	1,008	99	10%	26	17	65%	8	31%
19th/Oakland	540	31	6%	26	11	42%	23	90%
24th/Mission	535	42	8%	24	14	57%	9	36%
Antioch	221	29	13%	82	4	5%	23	28%
Ashby	471	64	14%	37	14	37%	8	21%
Balboa Park	287	27	9%	21	6	30%	6	29%
Bay Fair	499	39	8%	52	9	18%	25	48%
Berryessa/North San Jose	126	12	10%	38	4	11%	11	30%
Castro Valley	986	73	7%	130	17	13%	26	20%
Civic Center	1,504	153	10%	26	21	81%	23	89%
Coliseum	726	64	9%	42	13	31%	42	100%
Colma	722	66	9%	118	23	20%	15	13%
Concord	1,202	95	8%	156	28	18%	36	23%
Daly City	527	44	8%	69	14	21%	25	36%
Downtown Berkeley	415	43	10%	16	11	66%	7	43%
Dublin	539	34	6%	126	23	18%	0	0%
El Cerrito Del Norte	651	63	10%	176	18	10%	95	54%
El Cerrito Plaza	207	15	7%	61	5	8%	9	15%
Embarcadero	504	52	10%	19	14	70%	7	37%
Fremont	556	35	6%	123	24	19%	0	0%
Fruitvale	1,138	79	7%	62	17	27%	59	94%
Glen Park	366	38	10%	45	8	17%	1	1%
Hayward	476	49	10%	52	12	23%	30	58%
Lafayette	68	8	12%	71	1	1%	0	0%
Lake Merritt	615	30	5%	32	10	30%	26	82%
MacArthur	420	34	8%	43	11	27%	28	66%

Station Name	# Crashes	# KSI Crashes	% Crashes Resulting in KSI	Street Mileage	HIN Mileage	% of Street Mileage along HIN	Street Mileage in EPC	% of Street Mileage within EPC
Millbrae	442	51	12%	111	15	13%	3	3%
Milpitas	252	15	6%	39	3	7%	0	0%
Montgomery St	821	73	9%	24	18	73%	13	53%
North Berkeley	331	39	12%	36	13	35%	0	0%
North Concord	293	29	10%	80	8	9%	1	2%
Orinda	38	9	24%	72	0	0%	0	0%
Pittsburg	324	39	12%	92	6	6%	44	48%
Pittsburg Center	292	38	13%	54	8	15%	54	100%
Pleasant Hill	823	56	7%	159	20	12%	3	2%
Powell St	1,172	106	9%	23	19	83%	18	80%
Richmond	587	50	9%	67	9	14%	67	100%
Rockridge	117	11	9%	35	4	11%	0	0%
San Bruno	900	89	10%	136	28	21%	60	44%
San Leandro	359	37	10%	54	10	18%	41	76%
South Hayward	157	22	14%	36	6	16%	20	57%
South San Francisco	553	56	10%	110	27	25%	15	13%
Union City	339	26	8%	101	16	15%	0	0%
Walnut Creek	725	38	5%	138	12	9%	0	0%
Warm Springs/South Fremont	230	10	4%	38	2	4%	0	0%
West Dublin	415	28	7%	113	6	5%	0	0%
West Oakland	454	31	7%	52	10	19%	36	70%