



Waymo Safety Impact Data Hub

Introduction —

[The Waymo Safety Impact Data Hub](#) highlights Waymo's Rider-Only (RO) safety performance by comparing its crash rates to human benchmarks from the areas where Waymo operates. The Data Hub also includes several download files to help researchers reproduce the results or conduct their own research. The Data Hub is envisioned as a living dataset, which will be updated over time with both new data as it is released and new methodologies

based on new research. This document is a detailed description of new releases of the data. It contains a high level overview of each release, including download links to historical versions of the data. It also contains details that explain and contextualize changes in the data or methods used on the Data Hub. Finally, there is a set of data dictionaries for the downloaded data that describe the content and format of the download data.

Release Notes —

Publish Date	Data End Date (Year Month)	NHTSA SGO Data Publish Date	Waymo Data Hub Files	Release Description
October 2, 2026	2026 June	August 17, 2026	CSV3 - Collision count, and comparisons to benchmark CSV4 - Miles and Benchmark Crashes for Dynamic Benchmark	After the September 24, 2026 release, we discovered a data error in the CSV4 download file. An upstream data processing error caused several S2 cells to be repeated. This error only affected the Atlanta area benchmark data (DeKalb and Fulton Counties). This first error affected the calculation of the dynamic benchmarks for the Atlanta area. Additionally, a second error was found where the wrong benchmark year was used to generate the CSV4 file. This second error was isolated to CSV4 and did not affect the calculated rates in CSV3. We have corrected both errors and republished CSV3 and CSV4 for the release of data through June 2026. These new files should replace the files released on September 24. The CSV1 and CSV2 files are unchanged.
September 24, 2026	2026 June	August 17, 2026	CSV1 - RO Miles per Location CSV2 - Crashes with SGO identifier and group membership CSV3 - Collision count, and comparisons to benchmark CSV4 - Miles and Benchmark Crashes for Dynamic Benchmark	- Updated data using NHTSA SGO through June 2026. - Waymo requested a police crash report from a crash involving two Waymo vehicles (SGO report 30270-13817) following our established methodology. At the time of the prior data hub release (June 24, 2026), the request remained unfulfilled. As a result, the status of this crash was indicated as “Unknown” for the “Suspected Serious Injury+” outcome level. Since the last release, there is still no police crash report available for this crash. Through a separate public information request, Waymo received a “General Offense Report” related to this crash. This report indicated that the driver of one of the non-Waymo was treated at a hospital for injuries described as life threatening. Given our established methodology of relying on the police crash report injury severity to determine the “Suspected Serious Injury+” outcome, we have continued to label this crash as “Unknown” for this release. We will update the status of this crash in future releases as more information becomes available. If this crash were treated as a “Suspected Serious Injury+” outcome, the resulting crashed vehicle rate would be 0.018 Incidents Per Million Miles (IPMM) compared to the current reported rate of 0.011 IPMM compared to the aligned human benchmark of 0.2133 IPMM.

Publish Date	Data End Date (Year Month)	NHTSA SGO Data Publish Date	Waymo Data Hub Files	Release Description
June 24, 2026	2026 March	June 15, 2026	CSV1 - RO Miles per Location CSV2 - Crashes with SGO identifier and group membership CSV3 - Collision count, and comparisons to benchmark CSV4 - Miles and Benchmark Crashes for Dynamic Benchmark	- Updated data using NHTSA SGO through March 2026. - Added benchmarks and comparisons for the Atlanta Area. These benchmarks are from Scanlon et al. (2026) for calendar year 2022, which is consistent with the existing benchmarks used on the data hub. The dynamic location adjustment uses the same method as the existing areas described by Kusano et al. (2025). Like the San Francisco Bay Area, “Atlanta Area” is used in the output tables to represent a combined aggregation of the counties that make up the Waymo service area that is currently in parts of Fulton and DeKalb Counties. The output files also include individual reporting for Fulton and DeKalb Counties. - Georgia state crash data only includes crash-level information on airbag deployments, and thus it is not possible to derive a vehicle-level ego airbag deployment benchmark for the Atlanta Area. Ego airbag deployment crashes involving Waymo vehicles are still reported in CSV3, but there is no benchmark present for this outcome in Atlanta.
March 19, 2026	2025 December	February 17, 2026	CSV1 - RO Miles per Location CSV2 - Crashes with SGO identifier and group membership CSV3 - Collision count, and comparisons to benchmark CSV4 - Miles and Benchmark Crashes for Dynamic Benchmark	- Updated data using NHTSA SGO through December 2025. - Reporting across all results was changed from a “Location” (e.g., San Francisco) to state and county. We made this change because some current and future service areas span across several counties. In addition to county-level results, the CSV3 (and results on the data hub) aggregate several counties into service areas. For example, the “San Francisco Bay Area” results include all crashes and miles driven in San Francisco, San Mateo, and Santa Clara Counties. - A “Any Fatal Injury” outcome and benchmark comparison have been added to the CSV downloads. The benchmark uses crash involvement rates in crashes with any fatal injury reported by Scanlon et al. (2024) and the spatial dynamic adjustment used by Kusano et al. (2025).

Publish Date	Data End Date (Year Month)	NHTSA SGO Data Publish Date	Waymo Data Hub Files	Release Description
December 16, 2025	2025 September	November 17, 2025	CSV1 - RO Miles per Location CSV2 - Crashes with SGO identifier and group membership CSV3 - Collision count, and comparisons to benchmark CSV4 - Miles and Benchmark Crashes for Dynamic Benchmark	- Updated data using NHTSA SGO through September 2025. - We added a new outcome and benchmark for “Ego Airbag Deployment,” which is described in more detail in the detailed release notes below. - SGO case 30270-11013 was previously reported as having a delta-V < 1 mph. After reviewing the crash reconstruction of this case, we have determined the delta-V in the crash was greater than 1 mph and thus have changed the designation of this case. - We have revised the Crash Type designation for the following 3 crashes after review of the case materials: 30270-7883, 30270-8581, 30270-8933.
September 16, 2025	2025 June	August 15, 2025 (amendment 2 file , amendment 3 file)	CSV1 - RO Miles per Location CSV2 - Crashes with SGO identifier and group membership CSV3 - Collision count, and comparisons to benchmark CSV4 - Miles and Benchmark Crashes for Dynamic Benchmark	- Updated data using NHTSA SGO through June 2025. - The NHTSA SGO was modified with the so-called “amendment 3” which went into effect after June 16, 2025. See the detailed release notes on how this change in reporting requirements was integrated into the Waymo Safety Impact Data Hub. - Two previously reported SGO cases inadvertently were missing unredacted incident date, location, and zip code in the CSV2 download (30270-10089, 30270-9821). This information has been added in this release.

Publish Date	Data End Date (Year Month)	NHTSA SGO Data Publish Date	Waymo Data Hub Files	Release Description
June 12, 2025	2025 March	May 15, 2025	CSV1 - RO Miles per Location CSV2 - Crashes with SGO identifier and group membership CSV3 - Collision count, and comparisons to benchmark CSV4 - Miles and Benchmark Crashes for Dynamic Benchmark	- Updated data using NHTSA SGO through March 2025 (using SGO file released on April 15, 2025) - We have updated the data hub website to focus on the highest severity outcomes: serious injuries or worse, airbag deployment, and any-injury-reported. These outcomes were the primary focus of our recent paper (Kusano et al., 2025) because they directly measure safety relevant outcomes. We have stopped reporting police-reported crash results on the data hub, but these results are still available for download in CSV3. As noted by Kusano et al. (2025), police-report data in California has systematic underreporting of property damage only crashes, making it more difficult to compare police-reported crash rates in California to other locations. - Case 30270-9987 has two rows in the CSV2 output because this is a single SGO collision report that involves 2 Waymo vehicles. One of the Waymo vehicles was parked in a valid parking space, and thus was not-in-transport at the time. - CSV1 includes miles driven in Atlanta, GA and Mountain View, CA. There were no SGO-reported crashes in Atlanta and 2 SGO-reported crashes in Mountain View (both of which resulted in only property damage). Comparisons to benchmarks in these two cities were not performed due to limited miles. The miles and crashes from these two cities were not included in the All Locations (mileage blended)” analysis. - The “Phoenix and San Francisco” outcome has been removed from CSV3, as we are now showing results for “All Locations (mileage blended)” on the datahub. Locations were updated in all CSVs. - The schema of CSV3 has changed to include (1) the “Suspected Serious Injury+” result (referred to as “serious injury or worse” on the data hub) and (2) outcomes by crash type. See the data dictionary below for these changes.

Publish Date	Data End Date (Year Month)	NHTSA SGO Data Publish Date	Waymo Data Hub Files	Release Description
March 19, 2025	2024 December	February 18, 2025	CSV1 - RO Miles per Location CSV2 - Crashes with SGO identifier and group membership CSV3 - Collision count, and comparisons to benchmark CSV4 - Miles and Benchmark Crashes for Dynamic Benchmark	- Updated data using NHTSA SGO through December 2024 (using SGO file released on February 18, 2025) - Human benchmarks for Austin, Texas were added to the comparisons in CSV3. These benchmarks were developed from public Texas state crash and vehicle miles traveled data in a similar fashion as the California and Arizona benchmarks described by Scanlon et al. (2024). - A new field “SGO Report Version” was added to CSV2 to clarify which SGO report version is being used for this data (see link to SGO data published February 18, 2025). - There were some updates for individual cases in the CSV2 field “Is NHTSA Reportable In-Transport Delta-V Less than 1 MPH”. Three crashes involving small animals were examined and judged to have a delta-V less than 1 mph (30270-8120, 30270-8612, and 30270-8632). One crash was removed from the “Is NHTSA Reportable In-Transport Delta-V Less than 1 MPH” because after examination this case involved a motorcycle, which is ineligible for this less than 1 mph delta-V designation (30270-4768).
January 6, 2025	2024 September	November 15, 2024	CSV1 - Miles per Geo CSV2 - Crashes with SGO identifier and group membership CSV3 - Collision count, and comparisons to benchmark CSV4 - Geographic Adjustment	- Updated data using NHTSA SGO through September 2024 (using SGO file released on November 15, 2024) - We discovered an error in the CSV2 download released on October 24, 2024. The column “Is Any-Injury-Reported” mistakenly used the old SGO-based method from the September 5, 2024 release and not the updated methodology. As a result, 8 cases were reported as FALSE for the “Is Any-Injury-Reported” column that are now reported as TRUE. This error only applied to the CSV2 column values. The rates previously presented on the Data Hub site and in CSV3 correctly used the updated injury definition. - Case 30270-8750 was included in the RO dataset. The “Driver / Operator Type” field for this SGO event states “Other, see Narrative”. The narrative states “At the time of the impact, the Waymo AV’s Level 4 ADS was engaged in autonomous mode”, consistent with there being no driver behind the wheel. - There are no changes to the methodology used to generate the files or results.

Publish Date	Data End Date (Year Month)	NHTSA SGO Data Publish Date	Waymo Data Hub Files	Release Description
October 24, 2024	2024 July	September 15, 2024	CSV1 - Miles per Geo CSV2 - Crashes with SGO identifier and group membership CSV3 - Collision count, and comparisons to benchmark CSV4 - Geographic Adjustment	- Updated data using NHTSA SGO through July 2024 (using SGO file released on September 16, 2024) - Updated methodology to identify Any-Injury-Reported outcomes in the SGO data. Instead of using the “Highest Injury Severity Alleged” SGO field directly, cases were manually reviewed and reported injuries of unknown severity in the case materials (such as the narrative) were included. See section below for more detailed explanation and analysis of the impact of this change. - Added a dynamic adjustment to the human benchmarks used in the Data Hub based on new research that accounts for differences in geographic distribution of driving between the Waymo RO fleet and the human population. See details below. - Added a new data download file, CSV4, that contains the spatial distribution of mileage for each geo. This information enables the replication of the dynamic benchmark adjustment reported on the data hub. See the detailed release notes and data dictionary for details. - Added an additional column to the “CSV2 - Crashes with SGO identifier and group membership” data file, “Location”, that describes the city in which the crash occurred (e.g., PHOENIX, SAN_FRANCISCO). - The ‘Incident Date’ in CSV2 was updated for three events (30270-8157, 30270-7938, 30270-6542), which had mistakenly listed the ‘Notice Received’ date instead of the ‘Incident Date’ in the previous release.
September 5, 2024	2024 June	August 15, 2024	CSV1 - Miles per Geo CSV2 - Crashes with SGO identifier and group membership CSV3 - Collision count, and comparisons to benchmark	- First release of Safety Impact Data Hub using NHTSA SGO through June 2024 published on August 15, 2024 - Uses human benchmarks reported in Scanlon et al. (2024a) and outcomes from Kusano et al. (2024)

Detailed Release Notes—

December 16, 2025 Release

Since the first publication of the Waymo Safety Impact Data Hub and in our peer-reviewed research, we have presented an outcome of “Airbag Deployment.” This outcome was assigned to an SGO crash if an airbag in any vehicle involved in the crash sequence had an airbag deployment. Since this was the only airbag deployment outcome we presented, we shortened the name to “Airbag Deployment” but a more complete name is “Any Vehicle Airbag Deployment.” All the crash rates reported on the data hub are crashed vehicle rates. So the “Any Vehicle Airbag Deployment” outcome describes how many crashes a vehicle is involved in with an airbag deployment in any vehicle per vehicle miles traveled (VMT). Another airbag related outcome is an “Ego Vehicle Airbag Deployment,” which means the rate of crashes where airbags deploy in only the ego or subject vehicle per VMT. Today we are adding an “Ego Vehicle Airbag Deployment” outcome and benchmark to the data hub to provide an additional measure of crashes involving airbag deployment.

The “Any Vehicle Airbag Deployment” outcome provides some technical advantages over the “Ego Vehicle Airbag Deployment” outcome. First, airbags deploy in different ways depending on the crash configuration. The threshold for deploying a side airbag, for example, is generally less than deploying a frontal airbag. Second, reaching the deployment trigger for an airbag is dependent on the ratio of vehicle mass in a crash. Crash physics dictates that the heavier vehicle has a lower change in velocity than the lighter vehicle in a crash. Electric vehicles, like the ones Waymo operates, tend to be heavier than similarly sized vehicles, meaning there is generally a decrease in delta-V, and thus a slightly lower likelihood of an airbag deployment, in the Waymo vehicle relative to the collision partner. Focusing only on an “Ego Vehicle Airbag Deployment” outcome may bias a safety evaluation, because it would exclude crashes that are of sufficient severity to deploy any airbag when the ego vehicle airbag does not deploy. Regardless of these advantages, we believe it is important to present data both for “Any Vehicle Airbag Deployment” and “Ego Vehicle Airbag Deployment” outcome because crash data derived from certain types of vehicle telematics sources will only have information on “Ego Vehicle Airbag Deployment” status.

An “Ego Vehicle Airbag Deployment” benchmark was derived from the same police-reported data sources and methods used in Kusano et al. (2025). In order to identify the previously published “Any Vehicle Airbag Deployment” outcome, the data were analyzed on the vehicle level to identify crashed vehicles with an airbag deployment. The same analysis was used to identify the “Ego Vehicle Airbag Deployment” crashed vehicles. Because it uses the same data sources and methods as the previously published “Any Vehicle Airbag Deployment” benchmark, we believe the “Ego Vehicle Airbag Deployment” is sufficiently similar to the methodology in our peer-reviewed research to include at this time on the data hub website. See Kusano et al. (2025) and Scanlon et al. (2024) for a full description of the benchmark data analysis method and limitations, which also apply to the “Ego Vehicle Airbag Deployment” benchmark.

Table 1 shows the comparison of Waymo and benchmark “Ego Vehicle Airbag Deployment” crashed vehicle rates through 127 million RO miles. These comparisons are also available in the CSV3 download file. Case lists with SGO identifier for the ego vehicle airbag deployment outcome were also added to the CSV2 download file. Like the “Any Vehicle Airbag Deployment” outcome, the reduction in “Ego Vehicle Airbag Deployment” is statistically significant in all locations combined, and in Phoenix, San Francisco, Los Angeles, and Austin when considered individually.

Table 1. Comparison of Waymo and Benchmark Ego Vehicle Airbag Deployment Rates through 127 million Rider-Only Miles (through September 2025).

Location	Waymo Count	Waymo IPMM	Benchmark IPMM	Prevented Crashes	Waymo Percent Difference	Percent Difference 95% Confidence Interval
All Locations	7	0.055	1.125	136.0	-95%	-89% -98%
Phoenix	3	0.053	0.965	51.6	-95%	-82% -99%
San Francisco	4	0.103	1.315	47.0	-92%	-78% -98%
Los Angeles	0	0.000	0.953	24.3	-100%	-85% -100%
Austin	0	0.000	2.073	13.1	-100%	-72% -100%

As discussed in the detailed release notes for the September 16, 2025 release, the NHTSA SGO amendment 3 changed the reporting requirements for crashes that resulted in property damage only. Therefore, we have

removed the “Any Property Damage or Injury” outcome from the CSV3 download file. These events are still identifiable from the case listings in the CSV2 download file. Please refer to the September 16, 2025 detailed release notes below for more details.

In the last data release (September 16, 2025), we noted that the zip code field had been removed from the NHTSA SGO submission form. As a result, no unredacted zip code was added to the CSV2 download file. The location address is still provided, which can enable identification of those missing zip codes. NHTSA recently added the zip code field back into the data submission form. Some of the SGO reports starting in September 2025 now have unredacted zip code in the CSV2 download file. Those reports from crashes occurring in June through September 2025 where there was no zip code submitted to the SGO do not have unredacted zip code reported in the CSV2 download file.

References

- Kusano, K. D., Scanlon, J. M., Chen, Y. H., McMurtry, T. L., Gode, T., & Victor, T. (2025). Comparison of Waymo Rider-Only crash rates by crash type to human benchmarks at 56.7 million miles. *Traffic Injury Prevention*, 26(sup1), S8–S20. <https://doi.org/10.1080/15389588.2025.2499887>
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September 16, 2025 Release

The NHTSA Standing General Order (SGO) [Amendment 3](#) went into effect on June 16, 2025. The change aimed to reduce the number of reports and fields reported by ADS manufacturers. Some fields used to generate the data in Waymo’s Safety Impact Data Hub were changed, and as a result, the data processing was updated. First, the fields “SV Any Air Bags Deployed?” and “CP Any Air Bags Deployed?” (describing whether airbags were deployed in the subject vehicle, SV, or crash partner, CP) was combined into a single field “Any Air Bags Deployed?”.

The information is the same, and therefore, the outcome “Airbag Deployment” happened when an airbag deployment was noted in the “Any Air Bags Deployed?” field. Like was done previously, a manual examination of the video data was also performed to determine if an airbag deployed in any vehicle involved in the crash, in addition to the subject vehicle and crash partner vehicle. This inclusive definition of any airbag deployment matches how the human benchmark crashed vehicle rates were derived. Second, there were category changes to the “Highest Injury Severity Alleged” field. The Amendment 3 specifies the same 5-level scale as previous the previous SGO (“Fatality”, “Serious”, “Moderate”, “Minor”, “No Injuries Reported”) but adds “with hospitalization” and “without hospitalization” to each of the 4 injury levels (i.e., excluding “No Injuries Reported”). In the [data definitions](#) accompanying the SGO (page 20), “with hospitalization” is defined as injuries that “required hospitalization or emergency treatment.” This change in the “Highest Injury Severity Alleged” did not change the methodology used in the Waymo Safety Impact Data Hub. As was done previously, any crash with a “Highest Injury Severity Alleged” other than “No Injuries Reported” was treated as an “Any Injury Reported” outcome. If a “Unknown” value for “Highest Injury Severity Alleged” was reported and the SGO narrative or other case material noted an injury, then these “Unknown” injuries were also treated as the “Any Injury Reported” outcome. The “Serious Injury or worse” outcome (also referred to as “Suspected Serious Injury+” in some download files) continues to rely on the maximum severity noted in a police accident report obtained by a public records request. This public records request is done because the human benchmark is also derived from police-reported injury. Third, there is no longer a “Law Enforcement Investigating?” field. This change also does not change the identification of “Police-Reported” outcomes on the Waymo Safety Impact Data Hub, as we used the SGO fields and internal records to determine which cases likely had a police report filed.

There were also changes to how property damage only crashes are reported. In Amendment 2 and previously, ADS manufacturers were required to report all crashes and alleged crashes with any amount of property damage. Amendment 3 added lower reporting thresholds based on damage for crashes without injuries. In Amendment 3, a crash must be reported if there is over \$1,000 in property

damage, or the crash did not have \$1,000 in property damage but involved a single vehicle or the subject vehicle struck another vehicle or object. These lower reporting thresholds are expected to reduce the number of crashes reported to the SGO, as many crashes are of low severity. The Amendment 3 reporting requirements, however, do create an asymmetric reporting requirement where certain types of crashes are reported more often than others. Although this may be suitable for issue discovery, the new reporting thresholds make it impossible to compare Waymo's "Any Property Damage or Injury" SGO crash rate to human benchmarks, because no benchmark has this same asymmetric reporting requirement. We do not anticipate this reporting requirement change will affect the other outcomes reported on the Waymo Safety Impact Data Hub ("Police-Reported", "Any Injury Reported", "Airbag Deployment", and "Suspected Injury or Worse") because all of these outcomes will meet the Amendment 3 reporting requirements.

For this reason, the "Any Property Damage or Injury" outcome determined by the SGO data from amendment 2 and prior is not directly comparable to events reported under amendment 3. As stated in our prior research (Kusano et al., 2025, Kusano et al., 2024, Scanlon et al., 2024), the "Any Property Damage or Injury" benchmark is the least trustworthy benchmark available, because there are uncertainties on reporting threshold and underreporting that affect the human data. Because of this uncertainty in the benchmark and because of the changes to the reporting thresholds in the SGO amendment 3, we will no longer be reporting a comparison of Waymo's crash rate to the "Any Property Damage or Injury" benchmark in the CSV3 download. All SGO crashes, including property damage only crashes meeting the SGO amendment 3 reporting requirements, will still be included in the CSV2 download. Because the Amendment 3 reporting requirement went into effect on June 16 (the last 15 days of this release's reporting period), this release will be the last release with the "Any Property Damage or Injury" reported in the CSV3 download.

Last, the SGO amendment 3 changed some of the "unredacted" SGO fields that were previously provided under CSV2 (incident date, location address / description, and zip code). The SGO amendment 3 removed the location address / description and zip code fields while

the incident field remains on the report form. Waymo's practice is to state the location address / description in the SGO narrative. This address in the narrative is redacted by NHTSA before it is released in the public SGO data. Therefore, we will continue to include the "unredacted" incident date and location address / description (from the narrative) in CSV2. There will no longer be a zip code included in the CSV2 download, as there is no zip code reported on the SGO report form after amendment 3.

October 24, 2024 Release

As the purpose of the Waymo Safety Impact Data Hub is transparent sharing of Waymo's safety performance, the Waymo Safety Research team welcomes feedback from all members of the broader community. We would like to thank Tim Lee and Edouard Hesse for engaging with the data and contacting us, which led to some of the changes in this release. This analysis will continue to be revisited as new data is made available and methodology is developed.

Methodology Change for Any-Injury-Reported Identification in SGO Data

In the initial version of the data hub, the *Any-Injury-Reported* outcome was determined using the value in the "Highest Injury Severity Alleged" field of the SGO data. Any crash that had "Minor", "Moderate", "Serious", or "Fatality" coded in the "Highest Injury Severity Alleged" field was considered an *Any-Injury-Reported* outcome. This classification excluded crashes where the "Highest Injury Severity Alleged" was reported as "Unknown". After reviewing this classification, we identified several "Unknown" injury severity cases where a person alleged or reported an injury but the severity of the injuries was unknown. Although there are nuances with how "Unknown" injuries like these are reported in the human crash benchmarks, in order to follow the suggestions in the RAVE Checklist in Scanlon et al. (2024b) we will now include crashes with "Unknown" injury severity that have alleged injuries of unknown severity in the *Any-Injury-Reported* outcome. This determination will be made using manual review of the information in the SGO narrative.

This methodology change resulted in a small material change in the *Any-Injury-Reported* status of crashes. In total, 4 cases in the previous releases that were not considered *Any-Injury-Reported* are now being included

(30270-6149, 30270-7316, 30270-7637, 30270-7945). In addition, one SGO crash (30270-7157) previously had no injuries reported, but a revised report that was submitted in August 2024 (report version 3) indicated injuries of unspecified severity which we now consider an *Any-Injury-Reported* outcome. Of the new SGO crashes that occurred in July 2024 that were added to this data hub, two (2) SGO crashes (30270-8217, 30270-8243) had “Unknown” maximum severity with reported injuries that are now included in the *Any-Injury-Reported* outcome.

In addition, after reviewing the SGO narratives we have decided to include case 30270-4768 as an *Any-Injury-Reported* crash. According to the SGO narrative, the Waymo vehicle “was in a collision with a minibike whose rider was no longer on it” because “a minibike rider in the group lost control and fell off the minibike a short distance ahead of the Waymo AV in the adjacent lane and the minibike, without a rider, tumbled into the Waymo AV's lane.” The SGO “Highest Injury Severity Alleged” for this crash was “No Injuries Reported” because, as noted in the SGO narrative, the collision between the minibike without a rider and the Waymo AV did not cause the minor injuries to the minibike rider. Despite the nature of the crash sequence, we are including this case in the *Any-Injury-Reported* because an injury occurred in a collision sequence involving the Waymo AV, which matches the criteria for reporting in the human crash databases which make up the benchmark.

Spatial Distribution of Mileage Data for Download

Previously, only data was provided for download for the total Waymo driving mileage within the currently deployed geographic regions (CSV1). This update now provides an additional data download file, CSV4, which contains the spatial distribution of driving miles across the entire geographic regions where mileage has been accumulated. The data is provided by S2 cell (geometry level 13), which results in units of approximately 0.5 square miles (1.27 square kilometers). The purpose of providing this data is to enable external research that analyzes Waymo’s driving distribution to account for differences in crash risk by where the Waymo fleet was driven.

Dynamic Human Benchmark Adjustment

Based on recently published research (Chen et al., 2024), we are introducing new human benchmarks that are more

comparable to the geographic distribution of driving of the Waymo RO fleet. Waymo operates a ride-hailing service where the trips are largely driven by the demand of riders. Because of this demand, ride-hailing trips fall in more densely populated areas compared to the entire human driving population. The human crash benchmarks reported by Scanlon et al. (2024a) and reported previously on this Data Hub used this entire human driving population. We have heard feedback from many members of the public and researchers wondering how the unique driving distribution of a ride-hailing service might affect crash rates. In a new study by Chen et al. (2024), the effect of spatial distribution on crash risk was analyzed. A methodology was then developed to adjust benchmarks to account for the unique driving distribution of the Waymo driving. The result of the reweighting method is human benchmarks that are more representative of the areas of the city Waymo drives in the most, which improves data alignment between the Waymo and human crash data. Achieving the best possible data alignment, given the limitations of the available data, are part of the newly published Retrospective Automated Vehicle Evaluation (RAVE) best practices (Scanlon et al., 2024b).

The table below shows the overall and dynamically adjusted human benchmarks using the mileage blended benchmarks for the three main outcomes shown on the Data Hub. The results show that the Waymo RO service drives more often in areas with higher crash rates than the overall human benchmark, resulting in the dynamic human benchmark being 18% to 29% higher than the overall benchmark.

Comparison of Overall and Dynamic Human Benchmark Crashes Incidents Per Million Miles (IPMM) (Data through July 2024, Mileage Blended Benchmark).

Outcome	Overall Human Benchmark (IPMM)	Dynamic Human Benchmark (IPMM)	Ratio Dynamic to Overall Benchmark
Airbag Deployment	1.45	1.71	1.18
Any-Injury-Reported	2.97	3.84	1.29
Police-Reported	4.72	5.77	1.22

Because we believe the dynamic benchmark improves the alignment between the human and AV data, we will now use the dynamic human benchmarks in the results shown on the main Data Hub website for the Police-Reported, Any-Injury-Reported, and Airbag Deployment outcomes. We will continue to report the comparisons using the overall population human benchmarks previously used in the download section of the data (CSV3). The comparisons using the dynamic benchmark will be labeled with “dynamic” in the “Benchmark Comparison” column of CSV3 (e.g., “Airbag Deployment (Dynamic)”) while the comparison using the overall human benchmark will have no additional label (e.g., “Airbag Deployment”).

References

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Data Dictionary—

This section contains a description of the data elements in each file.

FILE

CSV1 - Miles per Geo

Data Element Name	Definition	Data Type	Allowable Values	Release Created	Release Updated
Ops Depot	Geographic location. Note this is the same field as “Location” in other CSVs	String	• LOS_ANGELES • PHOENIX • SAN_FRANCISCO • AUSTIN • ATLANTA • MOUNTAIN VIEW	September 7, 2024	June 12, 2025
Waymo RO Miles (Millions)	Waymo Rider-Only (RO) miles traveled in millions of miles.	Numeric	Positive number	September 7, 2024	N/A

FILE

CSV2 - Crashes with SGO identifier and group membership

Data Element Name	Definition	Data Type	Allowable Values	Release Created	Release Updated
SGO Report ID	NHTSA Standing General Order Report Identifier	String	A two-part integer identified separated by a dash, where the first part is the company code and the second part is the event identifier (e.g., 30270-8266)	September 7, 2024	N/A
SGO Report Version	NHTSA SGO report version	Integer	Positive integers starting at 1	March 19, 2025	N/A
SGO Amendment	The NHTSA SGO amendment number the SGO report was issued under.	String	• Amendment 2 or prior • Amendment 3	September 16, 2025	N/A
Year Month	Calendar year and month that crash occurred.	Integer	YYYYMM where YYYY is the century and year and MM is the calendar month.	September 7, 2024	N/A
State	The state name where the crash occurred.	String	A US state name, with capitalized first letter.	March 19, 2026	N/A
County	The county name where the crash occurred.	String	A county name.	March 19, 2026	N/A
Road Type	The type of road where the crash occurred.	String	• Surface Street • Freeway	March 19, 2026	N/A

Crash Type	The conflict partner and/or conflict type grouping. This is the same column as “Conflict Partner Type Group” in CSV3 (excluding the “All Crashes” value).	String	• Cyclist • Motorcycle • Pedestrian • Single Vehicle • V2V Backing • V2V F2R • V2V Head-on • V2V Intersection • V2V Lateral • Secondary Crash • All Others	June 12, 2025	N/A
Is NHTSA Reportable In-Transport	Indication whether this SGO crash was considered in the Any Property Damage or Injury outcome, which includes a requirement to not only be SGO-reported, but also for the Waymo vehicle to be in-transport (i.e., not parked) and impacted in the crashes. See Kusano et al. (2024) for details.	Boolean	TRUE or FALSE as a string	September 7, 2024	N/A
Is NHTSA Reportable In-Transport Delta-V Less than 1 MPH	Indicates whether this SGO crash had a delta-V less than 1 MPH, along with the in-transport and impacted requirements. This result is used to calculate the proportion of crashes with a delta-V less than 1 MPH on the Data Hub.	Boolean	TRUE or FALSE as a string	September 7, 2024	N/A
Is Police-Reported	Indication whether this SGO crash was considered in the Police-Reported outcome. See Kusano et al. (2024) for details.	Boolean	TRUE or FALSE as a string	September 7, 2024	N/A
Is Any-Injury-Reported	Indication whether this SGO crash was considered in the Any-Injury-Reported outcome. See Kusano et al. (2024) and these release notes for details.	Boolean	TRUE or FALSE as a string	September 7, 2024	N/A
Is Any Vehicle Airbag Deployment	Indication whether this SGO crash was considered in the Airbag Deployment outcome. Any airbag means an airbag deployed in any vehicle involved in the collision sequence. See Kusano et al. (2024) and these release notes for details.	Boolean	TRUE or FALSE as a string	September 7, 2024	December 16, 2025
Is Ego Vehicle Airbag Deployment	Indication whether this SGO crash had an airbag deployment in the ego (Waymo) vehicle.	Boolean	TRUE or FALSE as a string	December 16, 2025	N/A

Is Suspected Serious Injury+	Indication whether this SGO crash was considered in the Suspected Serious Injury+ (also referred to as serious injury or worse). See Kusano et al. (2025) for details.	Boolean	TRUE or FALSE as a string	June 12, 2025	N/A
Is Any Fatal Injury	Indication whether this SGO crash had a reported fatal injury for any person involved in the crash sequence.	Boolean	TRUE or FALSE as a string	March 19, 2026	N/A
Incident Date	The date the crash occurred.	Date	MM/DD/YYYY where MM is the month, DD is the day, and YYYY is the year.	September 7, 2024	N/A
Location Address / Description	The description of the location of the crash.	String	Examples are descriptions of cross streets, addresses, or other locations.	September 7, 2024	N/A
Zip Code	The zip code of the location of the crash.	Integer	5-digit zip code. Blank indicates missing value. Zip code is not reported for events reported after June 2025.	September 7, 2024	September 16, 2025

FILE

CSV3 - Collision count, and comparisons to benchmark

Data Element Name	Definition	Data Type	Allowable Values	Release Created	Release Updated
Outcome	Type of crash outcome	String	- Any Airbag Deployment - Any Injury - Ego Vehicle Airbag Deployment - Police Report - Suspected Serious Injury+	September 7, 2024	December 15, 2025
Benchmark Comparison	The benchmark that is used in the comparison	String	- Any Airbag Deployment - Any Airbag Deployment (non-Dynamic) - Any-injury-reported - Any-injury-reported (non-Dynamic) - Any-injury-reported (observed, non-Dynamic) - Any-injury-reported (Observed, Dynamic) - Ego Vehicle Airbag Deployment - Ego Vehicle Airbag Deployment (non-Dynamic) - Police-reported - Police-reported (non-Dynamic) - Suspected Serious Injury+ - Suspected Serious Injury+ (non-Dynamic)	September 7, 2024	December 15, 2025

State	The state name where the crash occurred.	String	A US state name, with capitalized first letter or an aggregated area (such as “All Locations (mileage blended)”)	March 19, 2026	N/A
County	The county name where the crash occurred.	String	A county name or an aggregated area (such as “All Locations (mileage blended)” or “San Francisco Bay Area”)	March 19, 2026	N/A
Grouping Type	The type of benchmark comparison.	String	- All Crashes - Aggregate Crash Type	June 12, 2025	N/A
Conflict Partner Type Group	The conflict partner and/or conflict type grouping. The value “All Crashes” is present when “Grouping Type” is also “All Crashes.” The remaining values are present when “Grouping Type” is “Aggregate Crash Type.” This is the same value as “Crash Type” in CSV2.	String	- All Crashes - Cyclist - Motorcycle - Pedestrian - Single Vehicle - V2V Backing - V2V F2R - V2V Head-on - V2V Intersection - V2V Lateral - Secondary Crash - All Others	June 12, 2025	N/A
Waymo Count	The number of Waymo RO crashes for this crash outcome.	Integer	Positive integer including zero	September 7, 2024	N/A
Delta V Less Than 1 Mph Percent	The percentage of Waymo SGO crashes in this outcome category with a delta-V less than 1 mph.	Numeric	Decimal between 0 and 1	September 7, 2024	N/A
Waymo IPMM	Waymo RO Incidents Per Million Miles (IPMM) in this outcome.	Numeric	Positive number	September 7, 2024	N/A
Waymo IPMM CI Lower	Waymo RO IPMM lower 95% confidence interval calculated using a Poisson Exact method. See Kusano et al. (2024) for calculation details.	Numeric	Positive number	September 7, 2024	N/A
Waymo IPMM CI Upper	Waymo RO IPMM upper 95% confidence interval calculated using a Poisson Exact method. See Kusano et al. (2024) for calculation details.	Numeric	Positive number	September 7, 2024	N/A
Benchmark IPMM	Human benchmark Incidents Per Million Miles (IPMM) in this outcome.	Numeric	Positive number	September 7, 2024	N/A
Benchmark IPMM CI Lower	Human Benchmark IPMM lower 95% confidence interval calculated using a Poisson Exact method. See Kusano et al. (2024) for calculation details.	Numeric	Positive number	September 7, 2024	October 17, 2024 (added missing CI in name)

Benchmark IPMM CI Upper	Human Benchmark IPMM upper 95% confidence interval calculated using a Poisson Exact method. See Kusano et al. (2024) for calculation details.	Numeric	Positive number	September 7, 2024	N/A
Predicted Benchmark Count	The average crash count predicted at the benchmark crash rate over the miles driven by Waymo.	Numeric	Positive number	September 7, 2024	N/A
Waymo Count Reduction	The Predicted Benchmark Count minus the Waymo Count, where a positive number indicates the Waymo RO service had few crashes than the average benchmark over the same distance.	Numeric	Real number	September 7, 2024	N/A
Waymo Percent Reduction	The percent reduction in crash rate from the human benchmark to the Waymo RO service. A negative number indicates the Waymo RO services had a lower crash rate than the benchmark. Note the percent reduction is the rate ratio minus 1.	Numeric	-1 to positive infinity	September 7, 2024	N/A
Waymo Percent Reduction CI Lower	The Waymo RO percent reduction lower 95% confidence interval calculated using a rate ratio method described by Nelson (1970). See Kusano et al. (2024) for calculation details.	Numeric	-1 to positive infinity	September 7, 2024	N/A
Waymo Percent Reduction CI Upper	The Waymo RO percent reduction upper 95% confidence interval calculated using a rate ratio method described by Nelson (1970). See Kusano et al. (2024) for calculation details.	Numeric	-1 to positive infinity	September 7, 2024	N/A
Waymo Rate Ratio	The ratio of the Waymo and benchmark crash rates.	Numeric	0 to positive infinity	September 7, 2024	N/A
Waymo Rate Ratio CI Lower	The rate ratio lower 95% confidence interval using a method described by Nelson (1970). See Kusano et al. (2024) for calculation details.	Numeric	0 to positive infinity	September 7, 2024	N/A
Waymo Rate Ratio CI Upper	The rate ratio upper 95% confidence interval using a method described by Nelson (1970). See Kusano et al. (2024) for calculation details.	Numeric	0 to positive infinity	September 7, 2024	N/A

Data Element Name	Definition	Data Type	Allowable Values	Release Created	Release Updated
Location	Geographic location	String	• LOS_ANGELES • PHOENIX • SAN_FRANCISCO • AUSTIN	October 24, 2024	June 12, 2025
S2 Cell	Geographic location specified by the S2 Cell system at zoom level 13.	String	A valid S2 cell, according to the S2 specification .	October 24, 2024	N/A
Outcome	Crash outcome group	String	• Airbag - A crash with an airbag deployment • Observed_any_injury - A crash with police-reported injury of any severity. • Blincoe_any_injury - An estimate of crashes with any injury reported using an underreporting correction from Blincoe et al. (2023) • Police_reported - police-reported crashes. • Blincoe - an estimate of crashes with any property damage or injury reported using an underreporting correction from Blincoe et al. (2023) • ka - A crash with maximum injury severity of "Killed" or "Incapacitation (A)" injury on the KABCO scale.	October 24, 2024	June 12, 2025
Benchmark Crash Count	Count of crashes in the human benchmark crash data source corresponding to this Outcome.	Numeric	Positive real number	October 24, 2024	N/A
HPMS Yearly Vehicle Miles Traveled	The annual human Vehicle Miles Traveled (VMT) in the S2 cell as reported in the Highway Performance Monitoring System (HPMS). This value is replicated across Outcome levels (i.e., each S2 Cell should have one VMT value).	Numeric	Positive real number	October 24, 2024	N/A
Waymo RO Miles	The number of miles traveled by the Waymo RO service in the S2 cell during the reporting period. This value is replicated across Outcome levels (i.e., each S2 Cell should have one RO Miles value).	Numeric	Positive real number	October 24, 2024	N/A

References

- Kusano, K. D., Scanlon, J. M., Chen, Y. H., McMurry, T. L., Chen, R., Gode, T., & Victor, T. (2023). Comparison of Waymo Rider-only crash data to human benchmarks at 7.1 million miles. *Traffic Injury Prevention*, 25(sup1), S66-S77. <https://doi.org/10.1080/15389588.2024.2380786>
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- Nelson, W. (1970). Confidence intervals for the ratio of two Poisson means and Poisson predictor intervals. *IEEE Transactions on Reliability*, 19(2), 42-49.