San Francisco
County Transportation
Authority

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Memorandum

AGENDA ITEM 10

DATE: September 4, 2025

TO: Transportation Authority Board

FROM: Tilly Chang – Executive Director

SUBJECT: 09/09/2025 Board Meeting: Approve the Conceptual Safety-Focused Autonomous Vehicle Permitting Framework Report

RECOMMENDATION ☐ **Information** ☒ **Action**

Approve the Conceptual Safety-Focused Autonomous Vehicle Permitting Framework Report

SUMMARY

Transportation Authority staff have developed a conceptual framework for incremental, performance-based permitting of autonomous vehicles (AVs) to enhance transparency and manage public risk of AV operations. The framework recommends that advancement through deployment stages be tied to performance on key safety metrics, with a strong emphasis on data transparency. We provide illustrative standards for permitting stage gates as well as examples of how these standards could be applied to permitees as they advance from testing phases to more complex commercial driverless operations. In addition to better supporting transparency, the proposed framework provides a structured pathway intended to manage public risks, recognizing that setbacks are a natural part of innovation. This enables public accountability and learnings to be applied, as the sector grows and matures over time.

☐ Fund Allocation

☐ Fund Programming

☐ Policy/Legislation

☒ Plan/Study

☐ Capital Project Oversight/Delivery

☐ Budget/Finance

☐ Contract/Agreement

☐ Other: ____________

BACKGROUND

San Francisco has emerged as a major center for AV testing and deployment, with multiple operators conducting AV operations throughout the city. While this innovation holds promise for improved mobility, it has also introduced significant safety and operational concerns.

Current state regulations administered by the California Department of Motor Vehicles (DMV) and California Public Utilities Commission (CPUC) offer limited transparency, insufficient performance standards, and few tools for managing public risk. Critical data such as total autonomous miles driven, safety performance metrics, and details on operational behavior are not available to the public or impacted local jurisdictions.

In response, Transportation Authority staff have developed a conceptual safety-focused AV permitting framework as requested by prior Board Chair Aaron Peskin. The framework proposes a phased, performance-based regulatory model to guide AV testing and deployment, with the goal of enhancing transparency and accountability, while mitigating safety and operational impacts.

DISCUSSION

The proposed framework outlines five progressive stages of AV deployment, beginning with safety-driver testing and culminating in unrestricted commercial driverless operations. Each stage is governed by operational constraints – such as geography, fleet size, and hours of operation – which are gradually lifted as operators meet performance benchmarks across key safety metrics, including:

- Collision rates
- Interference with emergency responders
- Unplanned stops and vehicle immobilizations
- Disengagements and vehicle retrievals

A key principle of the framework is that advancement through stages must be earned through demonstrated performance. This performance-based model would introduce a structured, risk-managed path for scaling AV operations while ensuring public accountability.

The framework also addresses a longstanding challenge: the lack of data transparency in AV oversight. It emphasizes the need for standardized, publicly available data reporting to support meaningful safety evaluation, informed public debate, and responsible regulatory action. Importantly, the framework recognizes that innovation involves setbacks, and it includes provisions for regulatory flexibility – such as provisional status or reversion to prior stages – rather than automatic permit suspensions.

Finally, the framework encourages local government participation in evaluating AV performance and aligning deployments with community needs. It demonstrates, through a hypothetical case study, how the approach could work in practice to support more deliberate, data-driven oversight of AV operations.

Transportation Authority staff engaged with public agencies and research and industry experts in conducting this study. We welcome further collaborations with regulators, industry, and researchers to develop this conceptual framework going forward.

FINANCIAL IMPACT

The requested action would not have an impact on the adopted Fiscal Year 2025/26 budget.

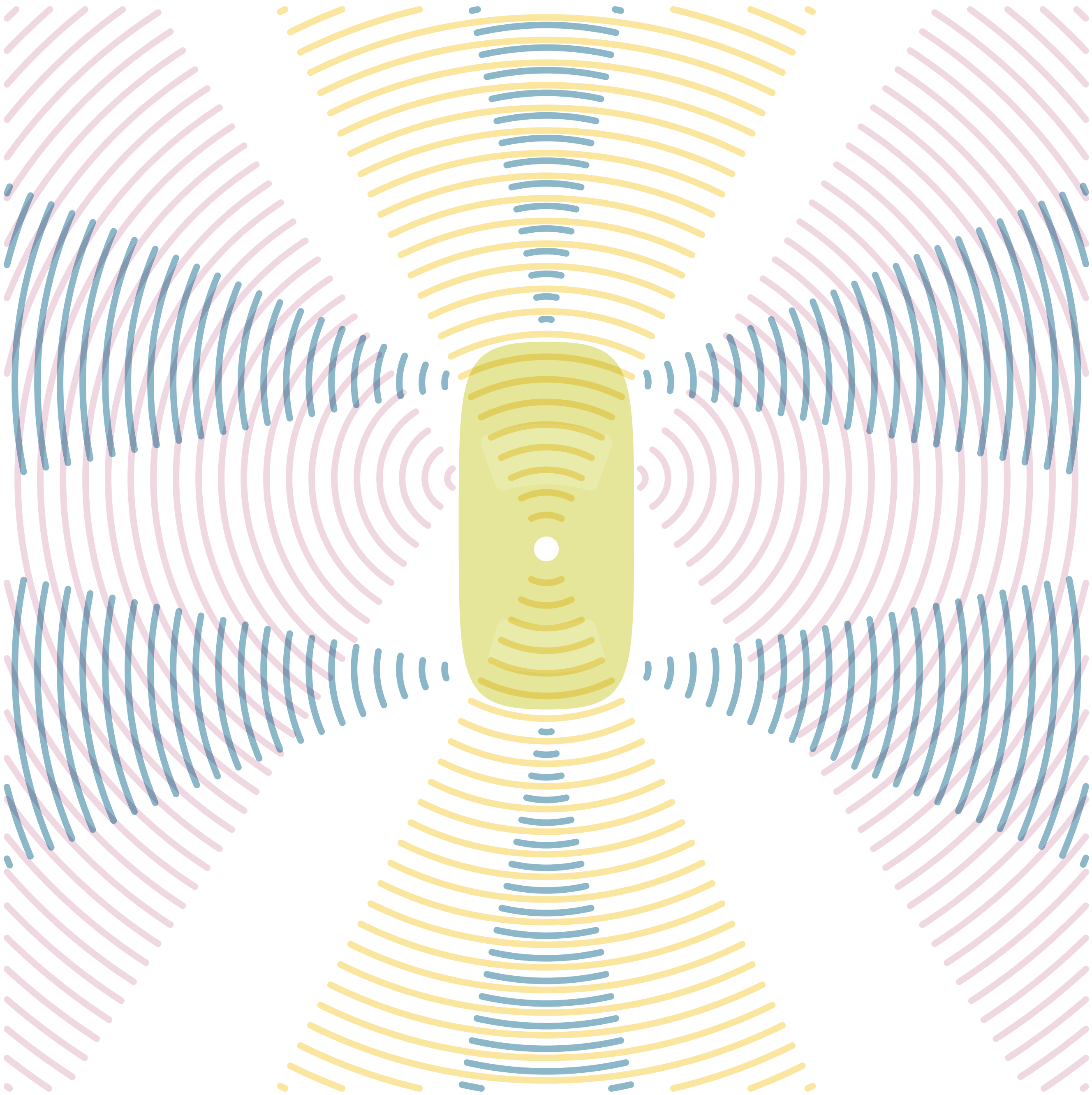
CAC POSITION

The CAC considered this item at its September 3, 2025 meeting and unanimously adopted a motion of support for the staff recommendation.

SUPPLEMENTAL MATERIALS

- Attachment 1 – Conceptual Safety-Focused AV Permitting Framework Report
- Attachment 2 – Resolution

ATTACHMENT 1



Conceptual Safety-Focused AV Permitting Framework

Toward an Incremental, Performance-based and Transparent Permitting Approach

San Francisco
County Transportation
Authority

Draft Report: August 2025

Acknowledgments

The San Francisco County Transportation Authority would like to thank Dr. Missy Cummings of George Mason University and Dr. Philip Koopman of Carnegie Mellon University for their advice and guidance in the development of this report.

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Executive Summary

San Francisco has become a leading hub for autonomous vehicle (AV) testing and deployment. AV activity has expanded rapidly over the years: one major operator is currently providing full commercial passenger service, several others are actively testing, and a major operator that previously tested and deployed extensively has since ceased operations. AVs provide a new mobility option in San Francisco while also introducing novel safety and operational concerns, as evidenced by San Francisco's experiences with crashes, interference with emergency response, and traffic violations involving AVs.

Current state regulations, administered by the California Department of Motor Vehicles (DMV) and the California Public Utilities Commission (CPUC), have enabled significant and rapid AV growth but lack sufficient transparency, performance standards, and mechanisms to effectively manage public risk. These gaps have created a regulatory environment with unclear – and therefore ineffective – safeguards for public safety and local mobility.

To address these challenges, the San Francisco County Transportation Authority (SFCTA) has developed a conceptual framework for incremental, performance-based permitting of AVs. It provides a structured pathway intended to manage public risks, recognizing that setbacks are a natural part of innovation. The framework enables public accountability and learnings to be applied as the sector grows and matures over time.

The framework outlines five progressive deployment stages – from initial testing with a safety driver to full commercial driverless operations – each governed by specific operational constraints such as fleet size, geography, hours of operation, and weather conditions. Advancement through each stage depends on an AV operator's ability to meet performance standards across critical safety metrics, including collision rates, first responder obstructions, unplanned stops, disengagements, and vehicle retrieval events. The framework emphasizes data transparency to ensure that AV deployment decisions are evidence-based, open to public review, and aligned with established road safety and mobility policy goals.

A simulated case study of a hypothetical AV operator demonstrates how the framework would function in practice, validating its ability to track performance, manage risk, and inform regulatory actions – including advancement through deployment stages, assignment of provisional status, or reversion to a prior stage.

The framework calls for transparent performance evaluation and recommends regulatory discretion to address context-specific issues, providing administrative flexibility in conducting oversight.

1. Introduction

1.1 CONTEXT

Following the passage of Senate Bill 1298 (Padilla) in 2012, the California Department of Motor Vehicles (DMV) established regulations for AV testing with a safety driver on public roads in 2014, and later, for driverless AV testing and deployment in 2018. The California Public Utilities Commission (CPUC), in turn, adopted regulations for piloting AV passenger services in 2018 and 2020, and for commercial AV passenger services in 2020 and 2021. According to the DMV, autonomous miles driven on California's public roads reached 9.1 million in 2023.[1] As of June 2025, there are 30 operators authorized to test AVs with a safety driver in the state, 6 operators authorized to test AVs without a safety driver, and 3 operators authorized to deploy AVs.

A significant portion of AV operations has been concentrated in San Francisco. Waymo and Cruise were the first companies to receive permits for testing AVs with a safety driver on California public roads in 2014 and 2015, respectively. In 2020, Cruise became the first company to receive a permit for driverless testing in parts of San Francisco. By 2022, both Cruise and Waymo were authorized to test and operate without a safety driver throughout the city. In 2023, both companies were granted approval to provide unrestricted, fared passenger services across all of San Francisco. However, later that same year, Cruise's permits for driverless testing and deployment were revoked following a serious injury collision. Waymo, meanwhile, continues to operate in San Francisco and has expanded its operations to parts of San Mateo, Santa Clara, and Los Angeles counties. More recently, Apollo received a permit for driverless testing in San Francisco in 2023, and Zoox was granted one in 2024.

The arrival of driverless AVs has added mobility options in San Francisco while introducing new safety and operational considerations to the city's transportation system. According to CPUC data, AV usage in San Francisco increased from 3,576 trips in March 2022 when the first commercial passenger service permits were issued to 400,731 trips in December 2024, indicating rapid growth of AV passenger services in the city.[2] Starting in 2025, Waymo, the only company currently licensed to provide commercial passenger service in San Francisco, stopped publicly disclosing local trip numbers. The National Highway Traffic Safety Administration (NHTSA) data shows that between July 1, 2021 and May 15, 2025, AVs were involved in 681 reported collisions in San Francisco.[3] The most

1 This figure reflects drivered and driverless testing VMT reported to the DMV, but not deployment VMT, which providers are not required to report. In 2024, reported testing VMT dropped to 4.5 million, likely due to a further shift in Waymo's operations from testing to deployment https://www.dmv.ca.gov/portal/vehicle-industry-services/autonomous-vehicles/disengagement-reports

2 California Public Utilities Commission, Autonomous Vehicle Programs: Quarterly Reporting, accessed August 15, 2025, https://www.cpuc.ca.gov/regulatory-services/licensing/transportation-licensing-and-analysis-branch/autonomous-vehicle-programs/quarterly-reporting.

3 National Highway Traffic Safety Administration. Standing General Order, ADS Incident Report Data. https://www.nhtsa.gov/laws-regulations/standing-general-order-crash-reporting. Accessed June 16, 2025.

serious incident occurred on October 2, 2023, when a Cruise AV struck, dragged and pinned a pedestrian until emergency responders arrived. Other reported operational issues have included interference with first responders, failure to yield to pedestrians, driving into oncoming traffic, blocking travel lanes and transit vehicles, and other traffic law violations. The lack of public data makes it unfeasible for city officials and other key stakeholders to conduct objective safety and operational assessments of the cumulative impacts (positive and negative) of AVs and may affect public confidence in the AV sector.

Current regulations in California and at the federal level lack transparent mechanisms to assess AV performance or mitigate the safety and operational risks AVs present to local jurisdictions. Even basic data needed to understand the extent of AV operations within any given jurisdiction, such as total autonomous miles driven by any given AV operator, is not made publicly available.

1.2 PURPOSE & NEED

San Francisco's experience highlights the need for regulations that guide the testing and deployment of AVs in an incremental, performance-based, and transparent manner. Such an approach would facilitate the successful integration of AVs while fostering greater public trust in their operations. Current regulations place much of the responsibility and decision-making in the hands of AV operators, who may not fully internalize the risks and broader costs that inadequate AV performance imposes on the traveling public. Regulations should permit the scaling and increasing complexity of AV operations only when operators can demonstrate strong performance against critical safety metrics. Additionally, local governments should have access to operational data to verify performance, provide input on mitigating risks, and ensure alignment with broader local transportation objectives.

The purpose of this document is to demonstrate what an incremental, performance-based AV permitting framework and process could look like, and how it could be applied in practice to mitigate some of the risks of AV deployment on public roads. The proposed framework incorporates the concept of incrementalism through a series of constraints on where and how AVs are tested and deployed, such as geographic area, hours of operation, fleet size, maximum speeds, and weather conditions. At each permit stage, these constraints are gradually lifted, allowing for broader and more complex AV operations. A performance-based approach is advanced through a series of safety metrics, including crashes, first responder obstructions, unplanned stops, and disengagements. Operators must meet specific performance standards over a predetermined number of vehicle miles traveled across these various metrics in order to advance to the next permit stage. Finally, the document provides an illustrative application of the proposed incremental permitting framework.

2. Current AV permitting framework in California

All vehicles, including AVs, are subject to a broad range of federal and state regulations in order to operate on public roadways. Federal authority primarily relates to establishing vehicle safety and emissions standards. State authority primarily addresses permitting of drivers and vehicles to operate on public roadways, carry passengers, establishing and enforcing traffic laws, and establishing liability and insurance regulations.[4] State and local jurisdictions enforce traffic laws, though local jurisdictions, including San Francisco, have little control or oversight of AVs on their streets.

2.1 FEDERAL VEHICLE SAFETY STANDARDS AND CRASH REPORTING REQUIREMENTS

The Federal government is primarily responsible for establishing vehicle (rather than operational) safety standards. NHTSA is responsible for establishing and enforcing Federal Motor Vehicle Safety Standards (FMVSS), as well as monitoring, investigating, and communicating with the public about motor vehicle safety issues and defects. NHTSA has issued guidance to states developing AV regulations, but has not adopted regulations that set minimum safety standards for automated driving systems (ADS). Purpose-built AVs may self-certify their compliance with FMVSS or NHTSA must approve an exemption, for example from the requirement to include a steering wheel. These exemptions, however, do not regulate any element of the software that performs the driving task. NHTSA, through its Standing General Order (SGO) requires reporting of autonomous vehicle collisions[5] and related fatalities, injuries and property damage, but does not require reporting of vehicle miles traveled (VMT), first responder obstructions, traffic rule violations, unplanned stops, and other important road safety information. Moreover, not all data reported to the SGO, is made available to the public, notably detailed location and other incident specifics.

2.2 DMV PERMITTING OF AUTOMATED DRIVING ON PUBLIC ROADS

The California Department of Motor Vehicles (DMV) has authority to permit AVs to operate on public roads in California and the mandate to develop regulations to "ensure the safe operation of autonomous vehicles on public roads."[6] California DMV regulations require permit applicants to identify the Operational Design Domain (ODD) and self-certify that a vehicle can safely operate within it. An ODD may include limitations on the geographic area, roadway type, speed range, environmental

4 National Highway and Traffic Safety Administration, Federal Automated Vehicles Policy, September 2016

5 Specifically, collisions on public roads, when the ADS was engaged at least 30 seconds prior to the collision, and where the collision results or allegedly results in property damage, injury, or fatality

6 California Vehicle Code 38750(d)(2). https://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?lawCode=VEH&division=16.6.&title=&part=&chapter=&article=

conditions (weather; time of day) or other constraints within which the manufacturer expects the vehicle to operate safely. The DMV may revoke a permit for operating outside the approved ODD.

The California DMV has established three levels of AV testing permits:[7]

1. **Testing with a Safety Driver** allows AVs to be tested with a safety driver present at all times. Members of the public may be conveyed, but not charged fares. Statewide, there are 30 companies with this permit.[8]
2. **Driverless Testing** allows for AVs to be tested without a safety driver present. Members of the public may be conveyed, but not charged fares. Statewide, there are 6 companies with this permit. Three of these are authorized to test without safety drivers in San Francisco.[9]
3. **Deployment** allows companies to make their AV technology commercially available. This type of permit may or may not include a requirement for a safety driver. A California DMV deployment permit is required to provide commercial autonomous ridehail services to the public. The California DMV has permitted 3 companies to commercially deploy AV services.[10]

Under the first two DMV testing permits, the DMV requires reports on collisions, disengagements, and VMT, but these reports are limited in scope and are released only once per year. At this time, the DMV has not adopted regulations that set minimum safety performance standards for AVs operating under a testing permit. Under the deployment permit, there are no data reporting requirements, and the DMV has not adopted regulations that set minimum safety performance standards.

2.3 CPUC PERMITTING OF PASSENGER SERVICE IN VEHICLE OPERATED BY AN AUTONOMOUS DRIVING SYSTEM

The CPUC oversees the testing and deployment of AVs for the purpose of providing commercial transportation services to the public. The CPUC has adopted broad goals for AV testing and deployment including protecting passenger safety, but the CPUC has not specifically articulated how to define or achieve these broad goals and declined to specify performance targets in relation to these goals.

The CPUC has established four levels of permitting:[11]

7 https://www.dmv.ca.gov/portal/vehicle-industry-services/autonomous-vehicles/autonomous-vehicle-testing-permit-holders/

8 Ibid, accessed June 23, 2025

9 Ibid, accessed June 23, 2025

10 Ibid, accessed June 23, 2025

11 https://www.cpuc.ca.gov/regulatory-services/licensing/transportation-licensing-and-analysis-branch/autonomous-vehicle-programs

1. Test driving with passengers and safety drivers but without fares.
2. Test driving with passengers without safety drivers and without fares.
3. Commercial deployment to provide public fared AV passenger service with a safety driver.
4. Commercial deployment to provide public fared AV passenger service without a safety driver.

From 2018 to 2021, the CPUC established data reporting requirements that remained in place until December 2024.[12] Operators with testing permits were required to provide aggregated data on VMT, waiting times, vehicle occupancy, and wheelchair-accessible rides. Operators with deployment permits were required to report trip-level data, including trip origin and destination, collisions, citations, complaints, and pickup/drop-off details. Following Decision 24-11-002, the CPUC revised its data reporting requirements to take effect in January 2025. The updated requirements align reporting for both testing and deployment permits and include more detailed information on VMT, collisions, complaints, citations, and vehicle stoppages (and subsequent obstructions of the right of way). However, initial reports have been highly redacted due to requests for confidential treatment. These claims are not public and have not been adjudicated by the CPUC, whose website lists them as "under review" going back more than 3 years. This issue mirrors the lack of disclosure of ridehail sector data from the CPUC, despite consistent rulings and decisions by the CPUC finding in favor of disclosure dating back 5 years.[13] Moreover, despite these changes, the CPUC has not yet adopted regulations setting minimum safety performance standards for AVs operating under its permits.

12 See decisions 18-05-043, 20-11-046, and 21-05-017

13 To date, however, only one year of TNC reports has been released publicly for 2021. See SFCTA's report TNCs 2020, here: https://www.sfcta.org/tncs-2020

3. Study Methodology

The methodology consists of three primary steps in developing this conceptual, incremental, performance-based permitting framework for AV passenger services.

First, a panel of experts in automation and roadway safety provided guidance on the operational constraints and parameters to ensure safe outcomes, proposed metrics and performance standards, and helped conceptualize permitting phases and how regulated entities would progress through these permitting phases. They also clarified the distinction between the concepts of "risk management", which is concerned with limiting the exposure of the public to potential danger arising from AV operations, and "proof-of-safety", which is concerned with demonstrating with statistical rigor the safety outcomes of AV operations. This conceptual framework is primarily concerned with risk management. However, the data reporting outlined in this document could be used to support proof-of-safety analyses in the long term.

The second step, informed by the guidance and feedback of the experts, developed a conceptual framework for incremental, performance-based autonomous vehicle permitting. The conceptual framework consists of an ordered set of operational phases defined by a set of operational parameters. Earlier phases are more restrictive in their operational parameters. As regulated entities progress to later phases, these operational parameters become increasingly permissive. Progression through these phases is contingent upon satisfying quantitative performance thresholds associated with specific performance metrics. The metrics and thresholds were informed by existing data reporting and automotive safety standards, iteratively refined with automation and roadway safety experts, and assessed for feasibility and reasonableness. The conceptual framework identifies the specific data items required to calculate the performance metrics.

The third step applied the incremental, performance-based autonomous vehicle permitting framework using example "synthetic" data to demonstrate how an entity would progress through the framework. Use of synthetic data was necessary because current AV data reporting requirements are inadequate to support a demonstration of the proposed framework. Application of the framework using synthetic data allowed the framework to be stress-tested and iteratively refined by illustrating potential issues and demonstrating how the process would work.

4. Proposed Incremental Framework

4.1 OVERVIEW

This section introduces a conceptual framework for incremental performance-based deployment of AVs with a focus on safety. The framework consists of phases that are constrained by operational parameters that become increasingly permissive as a company advances through the phases. This section first describes the operational parameters that define where, when, and at what scale AVs may operate in the conceptual framework. Next it outlines the deployment phases and the operational parameters at each phase. Then it describes the metrics to be used to evaluate performance at each phase, followed by "placeholder" performance standards for each metric used to evaluate a company's fitness for remaining in the current phase or advancing to the next phase. Finally, it provides guidance for how a regulator should use performance data to inform incremental permitting decisions.

4.2 OPERATIONAL PARAMETERS

The first structural element of the framework are the operational parameters that have an impact on road safety outcomes. The framework is set up so that, initially, these various parameters are strategically restricted, so as to allow AV operators to gain experience and understanding of the new geography with minimum risk of impacts on road safety and the efficient operation of the transportation system. As the entity accrues experience, improves their technology, and demonstrates good performance, the framework incrementally loosens the restrictions on these parameters, ultimately arriving at the stage in which there are no restrictions for driverless operations within the given geography.

The table below describes the parameters selected, the rationale for inclusion, potential negative impacts of their inclusion, and additional considerations of the parameter specific to the San Francisco context.

Table 1. Operational Parameters

OPERATING PARAMETER	REASON FOR INCLUSION	SF CONTEXT
Fleet size The number of vehicles an operator is authorized to operate	The more AVs in operation, the higher the likelihood of a road safety incident involving the operator — all other things being equal Promotes safety and transportation system performance by allowing the control of the scale of deployment and any associated impacts	Uber and Lyft combined were estimated to have up to 6,000 vehicles on the road at a time in San Francisco in 2016, with significant impacts[14]
Hours of operation The hours of the day that the operator is authorized to operate	Certain hours of the day bring about more exposure to other road users Promotes safety by restricting AV operations to times of the day when there are fewer road users present and less complex operating conditions	Traffic congestion is heaviest in San Francisco on weekdays from 7 to 9 AM and from 3 to 6 PM
Geography The area where the AVs are authorized to operate	The larger the authorized geography, the higher the likelihood that such geography includes areas where road safety incidents are more prone to happen, where emergency response activities are more intense, or where general traffic is heavier. Limits operations to smaller or less complex areas	Traffic congestion is concentrated in the northeast quadrant of San Francisco, where downtown and other dense neighborhoods are located and the transportation system is most complex.
Maximum speed The maximum speed the AVs are authorized to reach.	The higher the speed of the AV at the moment of impact, the higher the likelihood of serious injuries or other adverse consequences Promotes safety by potentially mitigating the severity of crashes	SF is lowering speeds on over 45 miles of roadways in the city.
Road type The type of road facility — freeways, major arterials, minor arterials, collectors, minor roads — that the operator is authorized to use.	Different road types carry more or less traffic and require different types of planning and maneuvering. Promotes safety by limiting the complexity and variety within the operating environment	-
Weather The weather conditions — rain, snow, ice, fog — that the operator is authorized for under a given phase of the process	Visibility and surface conditions may increase the likelihood of a collision Promotes safety by restricting AV operations with limited visibility or slippery road surfaces, among others, due to weather events	San Francisco can experience heavy fog, rain, and wind which limit visibility

14 TNCs were estimated to have contributed 50% of the growth in congestion in San Francisco from 2010 to 2016. Gregory D. Erhardt et al., Do transportation network companies decrease or increase congestion? Sci. Adv.5, eaau2670(2019). DOI:10.1126/sciadv.aau2670

4.3 INCREMENTAL DEPLOYMENT STAGES

The second element of the framework is the sequencing of authorized activities or deployment stages, i.e. how operators would incrementally progress along a series of stages for any given location, culminating in unrestricted commercial driverless service to passengers in that location. The proposed framework is composed of five incremental deployment stages, and puts in place a clearly defined path wherein access to the next stage of AV deployment is contingent on satisfactory performance under the prior stage. The proposed stages are:

1. **Testing with a Driver.** In this stage, the operator may allow the ADS to have control of the vehicle with a safety driver behind the wheel ready to take full control at any moment that the conditions on the road – for safety or other reasons – deem it necessary. The purpose of the safety driver is to mitigate risks associated with AVs operations. Safety incident rates at this phase should out-perform humans due to the presence of a trained safety operator. Safety incident rates during testing exceeding the incident rates of typical humans are a "red flag". Public passengers are not allowed during the testing phase.

2. **Driverless Pilot.** AVs are permitted to operate without the presence of a safety driver. The operational parameters are managed so that the risks and potential impacts of that transition are mitigated. For example, initially operations would only be authorized in the evening hours, with a small fleet and in lower density neighborhoods where the risks of a crash and of impacting traffic congestion are lower. Passenger service is permitted so that AVs may gain experience with pick up, drop off and other elements of passenger service, but AVs may not collect fares.

3. **Driverless Commercial.** An AV company is permitted to operate fared public passenger service. The phase has three sub-phases. In the first sub-phase entities are permitted to provide fared service to the general public, and to increase their fleet size. The second sub-phase authorizes entities to provide operations at higher speeds, in denser parts of the city, and at hours of more traffic. The third sub-phase authorizes operations throughout the city, at all times of day, with no restrictions other than a maximum fleet size.

The table below describes the increasingly permissive operational parameters throughout the five incremental deployment stages outlined above.

Table 2. Deployment Stages

PHASE	TESTING WITH DRIVER	DRIVERLESS PILOT	DRIVERLESS COMMERCIAL		
			1	2	3
Fleet size	100 vehicles per 250 thousand population	50 vehicles per 250 thousand population	100 vehicles per 250 thousand population	500 vehicles per 250 thousand population	1000 vehicles per 250 thousand population
Hours of operation	24/7	Evening hours	Evening hours	Midday & Evening hours	24/7
Geography	Few or no limitations on deployment area	Mainly low density, residential deployment areas	Mainly low density, residential deployment areas	Deployment area excludes the urban core	Few or no limitations on deployment area
Speeds	Up to 65 mph	Up to 25 mph	Up to 25 mph	Up to 35 mph	Up to 65 mph
Road types	Freeways, arterials, locals	Arterials, locals	Arterials, locals	Arterials, locals	Freeways, arterials, locals
Weather	All	Fair, up to minor rain/fog	Fair, up to minor rain/fog	Fair, up to minor rain/fog	All

4.4 PERFORMANCE METRICS

Advancement through the incremental stages of deployment shown in the framework should be contingent on demonstrated performance. This section proposes some potential key metrics for assessing an operator's road safety performance.

The proposed metrics combine a set of lagging metrics, i.e. actual negative road safety incidents involving the operator in question, and a set of leading metrics, i.e. events that may not necessarily compromise road safety on their own (although at times they do), but may be earlier indicators of higher risk of future poor performance.

Table 3 identifies a set of basic safety metrics, primarily presented as rates, to reflect differences in scale of operations by different entities. This table shows only the metrics used in the incremental, performance-based permitting framework illustrated in this document.

Table 3. Performance Metrics

METRIC TYPE	METRIC	NOTES
Safety	Property Damage Only (PDO) collisions / VMT	PDO collisions are an events of physical impact between an AV and another road user or property that only results in any property damage, and does not result in an injury or a fatality
	Injuries / VMT	Rate of injuries resulting from a collision between an AV and another road user or property that results in any injury, and does not result in a fatality
	Fatalities / VMT	Rate of fatalities resulting from a collision between an AV and another road user or property
	1st responder obstructions / VMT	Any incident reported by first responders wherein an AV obstructed the fulfillment of their duties Note: this metric is not currently reported to regulators
	Disengagements / VMT	Disengagements are instances when the ADS is precluded from performing the dynamic driving task (whether because of technology failure or situations requiring the test driver to take manual control)
	Unplanned stops > 2 minutes / VMT	Unplanned stops are instances in which an AV remains stopped on a travel lane for a certain amount of time when the conditions on the road require vehicle flow
	Unplanned stops > 15 minutes / VMT	Unplanned stops meaning instances in which an AV remains stopped on a travel lane for a certain amount of time when the conditions on the road require vehicle flow
	Vehicle retrieval events / VMT	Vehicle Retrieval Events are instances in which an AV needs to be retrieved from the road by a human operator or a tow truck
Extent of Operations	VMT (driven by driver)	The total miles traveled by the AV fleet with a human driver in control
	VMT (when in passenger service)	The total miles traveled by the AV fleet with a human passenger
	VMT (driven by ADS with driver present)	The total miles traveled by the AV fleet with a safety driver behind the wheel
	VMT (full driverless)	The total miles traveled by the AV fleet with ADS in control without a safety driver present

4.5 PERFORMANCE STANDARDS

The performance standards for each metric would identify what constitutes acceptable performance to remain in a stage or advance to the next. For injury rates, fatality rates, and PDO collision rates, the standard included is a "placeholder" set to the national rates for human drivers as documented by NHTSA, and remains the same throughout all stages, reflecting that it should never acceptable to have worse-than-human traffic safety outcomes. National rates are used for illustrative purposes in this document, understanding that national standards may not be the appropriate point of comparison for any specific jurisdiction due to differences in operational context and challenges with under reporting of human collisions. Implementation of this framework would require further work to establish the appropriate performance standards, like geographically specific rates, with full data on all relevant incidents from human drivers. It is also worth considering a higher bar than the rate for all human drivers, such as rates derived from alert and attentive human drivers. The thresholds for non-collision metrics are lowered (made more stringent) as the stages advance and the AVs are authorized to operate in more complex environments and at scale.

Table 4. Performance Standards by Phase

METRIC	TESTING WITH DRIVER	DRIVERLESS PILOT	DRIVERLESS COMMERCIAL			NOTES/JUSTIFICATION
			1	2	3	
Minimum VMT (cumulative)	-	2 million with a safety driver	1 million driverless	2 million driverless	5 million driverless	-
Property damage collisions / 100 Million VMT	132	132	132	132	132	2022 National average property-damage only collision rate
Injuries / 100 Million VMT	75	75	75	75	75	2022 National average traffic injury rate for human drivers
Fatalities / 100 Million VMT	1.33	1.33	1.33	1.33	1.33	2022 National average traffic fatality rate for human drivers, excluding alcohol-impaired drivers
1st-responder obstructions / 100 Million VMT	0	7,000	3,000	400	200	This is equivalent to ~1 event per week
Disengagements / 100 Million VMT	-	500,000	n/a	n/a	n/a	This is equivalent to ~10 events per week
Unplanned stops > 2 minutes / 100 Million VMT	-	500,000	167,000	25,000	12,500	This is equivalent to ~ 10 events per day
Unplanned stops > 15 minutes / 100 Million VMT	-	50,000	17,000	2,500	1,300	This is equivalent to ~1 event per day
Vehicle retrieval events / 100 Million VMT	-	7,000	3,000	400	200	This is equivalent to ~1 event per week

Sources: Property damage only collisions, fatalities, and injuries are based on the NHTSA Standing General Order database. Overview of Motor Vehicle Traffic Crashes in 2022.

4.6 REGULATORY DISCRETION

The framework outlines a process with clear metrics and performance standards which provide guidelines for a company's progression from more restrictive phases into more permissive phases. Failure to meet thresholds may also lead to the demotion of a permittee to a more restrictive phase, the revocation of a permit, or other enforcement actions. While the performance standards provide guidance on when enforcement actions may be appropriate, the decision to take an enforcement action and the severity of the action should be at the discretion of the regulator and should consider the severity of the triggering incident(s) and the context in which they occurred. The purpose of the guidelines is to convey expectations to industry and promote consistency in regulatory actions, while the purpose of regulatory discretion is to provide some flexibility to consider context. The decision to take, or not to take, an enforcement action should be justified and documented.

For example, an AV company may be involved in an injury collision early on in its deployment in which the other party is deemed at fault by investigators, and that no reasonable human driver in the AV's place would have been able to prevent it. In this case, if the incident results in minor property damage and no injuries, the regulator may choose to take no action, or if it results in serious injury, they may place the company into a provisional status. Alternatively, if the company was found to have acted negligently, or the technology created or exacerbated a situation that a human driver should have been able to avoid, the regulator may choose to restrict or revoke their operating license. In any case, the company should file the appropriate crash reports, and the regulator should track and publish their performance.

4.7 REPORTING AND TRANSPARENCY

The framework requires standardized, frequent data reporting from AV companies to establish their performance. These reports should be available to the public with limited exceptions for personally identifiable information. Public transparency will help ensure consistent and fair oversight by the regulator, help build public confidence in the technology and its oversight, and provide researchers with objective information on AV performance. Appendix A provides example templates that contain no personally identifiable information that can be made fully public. These reports are:

- Collision reports. These contain information on property-damage only collisions, injuries, and fatalities.
- Unplanned stop reports. These contain information on unplanned stops, vehicle retrieval events, and first-responder obstructions.
- VMT reports. These contain information on VMT and are structured to allow analysis of rates of property-damage only collisions, injuries, fatalities, unplanned stops, vehicle retrieval events, and first-responder obstructions.

5. Example Application

5.1 PURPOSE

This section presents an example application of how companies would proceed through an incremental performance-based permitting process. The example application demonstrates how data, metrics, and performance standards support the permitting framework, and how the framework can help mitigate risks to public safety. The example application uses synthetic performance data for a hypothetical AV company because current AV data reporting requirements are inadequate to support the proposed framework.

5.2 DATA SYNTHESIS NEEDS AND METHODOLOGY

Current AV data reporting is inadequate to support an incremental performance-based permitting process. AV mileage and crash reporting is incomplete and fragmented, and other than disengagements, no non-crash incident data was collected by any California regulator prior to January 1, 2025. This section identifies the reports that are required to support the proposed conceptual AV regulatory framework and describes methods for synthesizing data for an example application.

The following reports are required, for the purposes described below. See Appendix A for templates and example data.

- Vehicle miles traveled (VMT). VMT are necessary as the denominator for all event rate calculations (e.g., collisions per VMT)
- Collisions. Collision reports include information about the parties involved, injuries and fatalities, and are necessary for calculating collision rates, injury rates, and fatality rates.
- Disengagements. Disengagement reports are necessary for calculating disengagement rates
- Unplanned stops. Unplanned stop reports include event duration and whether the vehicle needed to be physically retrieved. Unplanned stop reports are necessary to calculate unplanned stop rates and vehicle retrieval rates.

Synthetic examples of the reports above were generated using simulation. The simulation represents a company with a fleet of vehicles that evolves over time. The fleet has operational constraints based on the active permit phase, targets to maintain that phase or advance to the next. Each vehicle within the fleet is simulated as a series of vehicle days with VMT from a distribution and event probabilities (for collisions, disengagements, and unplanned stops) based on event rates per VMT. The parameters used in the simulation were developed using the data sources below:

- NHTSA Overview of Motor Vehicle Traffic Crashes in 2022. Used to inform the simulated collision rates, injury rates, and fatality rates.
- CA DMV autonomous mileage reports (for driverless testing). Used to inform the arrival rate of new vehicles added to a company's fleet, the lifespan of vehicles, and the mileage driven per day.
- Local documentation of safety events. Used to inform unplanned stop rates.
- News/social media reports. Used to inform unplanned stop rates

The simulation was performed using the AV Data Synthesizer found here: https://github.com/sfcta/av_data_synthesizer.

5.3 EXAMPLE APPLICATION

This example application follows the progress of a hypothetical AV company, Omicron, through the incremental, performance-based permitting process.

Testing with Driver

Omicron began testing in January 2022. They conducted testing with a driver for 22 months to accumulate 2 million miles. During their entire testing phase, their safety and operational incident rates remained below acceptable thresholds (see Figure 1). As shown in Figure 2, at first their disengagements (in pink) increased throughout 2022 as number of vehicles in operation scaled up, then began to level off and decline as performance improved, then trailed off and ultimately disappeared as testing ended.

Figure 1. Testing Phase Report

```
Start: 2022-01-01    Current: 2023-10-01     End: None Days elapsed: 638
Status: ADVANCE
Active vehicles: 272

Vehicle Miles Traveled
----------------------
                        Driver VMT:         414079.00
               ADS With Driver VMT:        2614620.10 ADVANCE
            ADS Without Driver VMT:              0.00
                         VMT Total:        3028699.09
Collisions
-----------
       Property-damage only (rate):      0 (      0.00) ADVANCE < 132.0
                   Injuries (rate):      0 (      0.00) ADVANCE < 75.0
                 Fatalities (rate):      0 (      0.00) ADVANCE < 1.33
Operations
------------
             Disengagements (rate):   1501 ( 57407.96) ADVANCE < 500000.0
Unplanned stops > 2 minutes (rate):      0 (      0.00) ADVANCE < 500000.0
Unplanned stops > 15 minutes(rate):      0 (      0.00) ADVANCE < 50000.0
         Vehicle retrievals (rate):      0 (      0.00) ADVANCE < 7000.0
 1st responder obstructions (rate):      0 (      0.00) ADVANCE < 7000.0
```

Figure 2. Operational Events

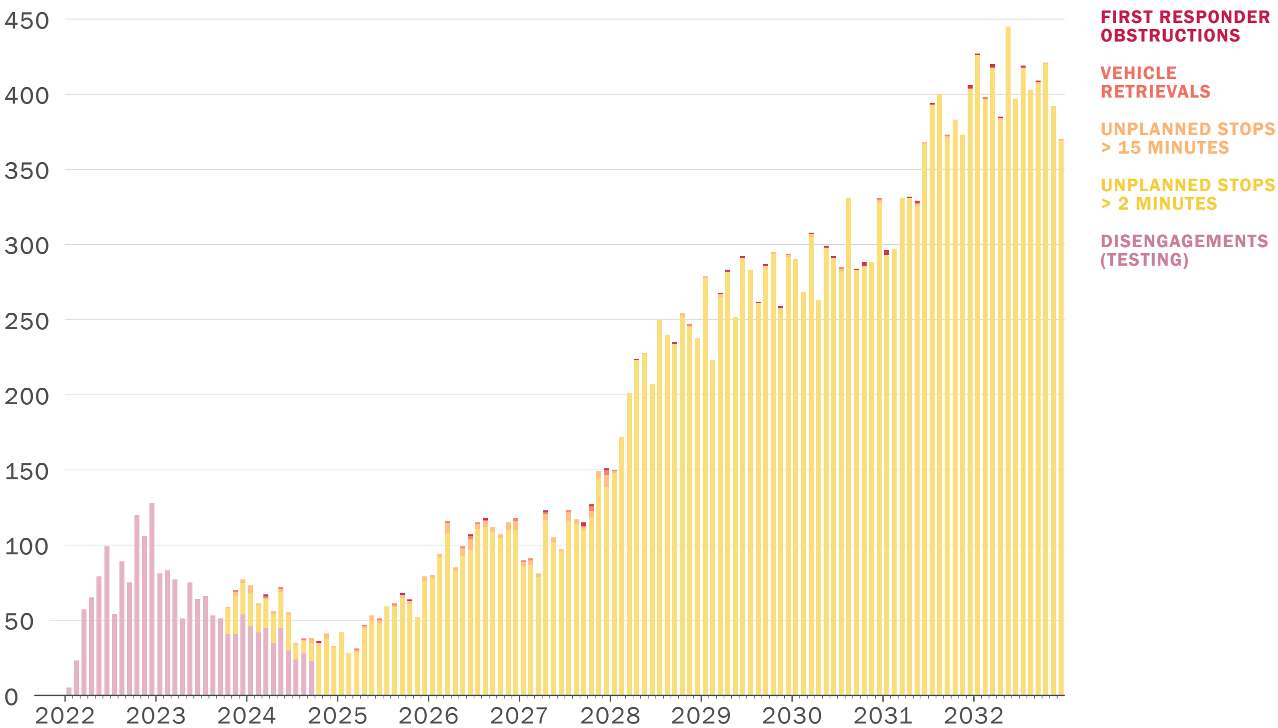
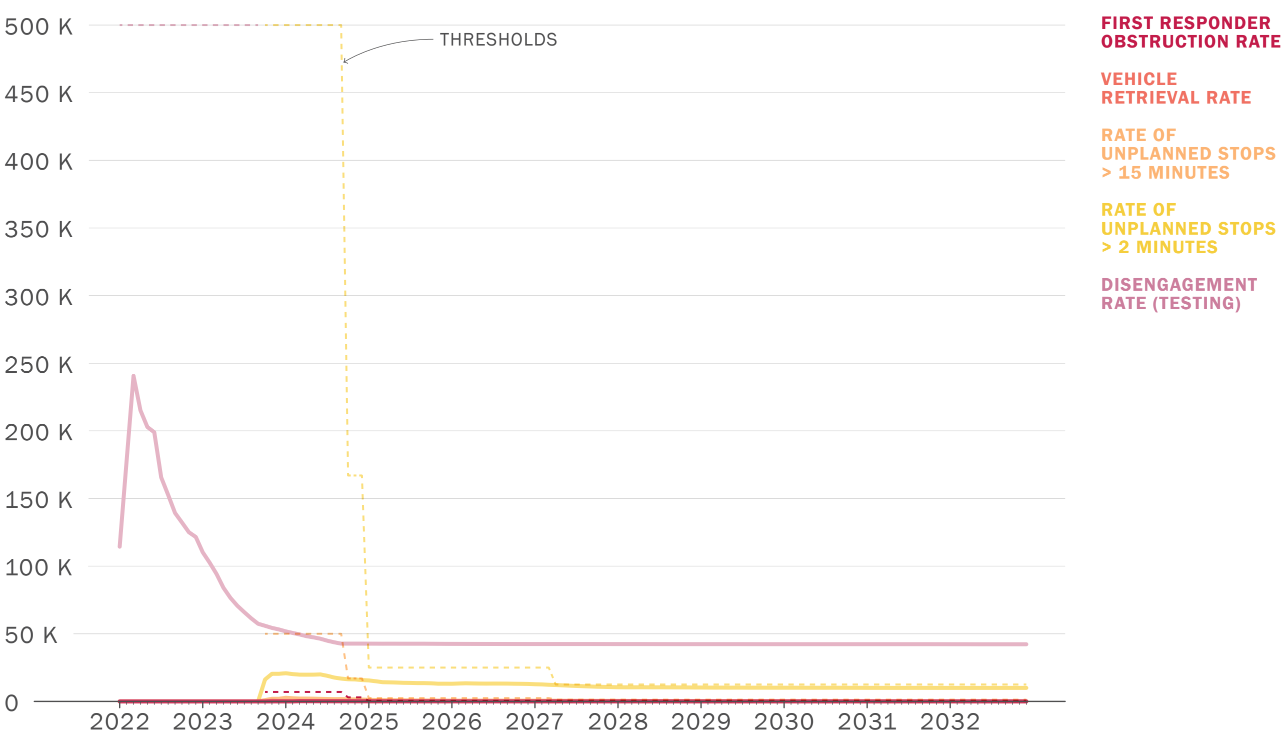


Figure 3. Operational Event Rates



Driverless Pilot

Omicron began driverless pilot service in October 2023, operating with 170 vehicles, while the balance of vehicles in Omicron's fleet continued testing. They reported their first property damage only collision the following month in November 2023, as shown in Figure 4. Because they had only accumulated 309,000 driverless miles in their first quarter, this caused their injury rate to climb to 324 injuries per 100 million VMT, exceeding the acceptable threshold of 132 property damage only collisions per 100 million VMT. Omicron was placed on provisional status requiring that every quarter they report a declining injury rate until they fell back below the 132 property damage only collisions per VMT threshold. Their rate continually declined and ultimately fell below the threshold in May 2024. By the end of the third quarter of 2024, Omicron reached the required 1 million VMT threshold and were permitted to advance to commercial service phase 1 (see Figure 6).

Figure 4. Pilot Phase Report at Time of First Injury

```
Start: 2023-10-01    Current: 2024-01-01     End: None Days elapsed: 92
Status: FAIL
Active vehicles: 130

Vehicle Miles Traveled
----------------------
                        Driver VMT:         470157.08
               ADS With Driver VMT:        3076598.84
            ADS Without Driver VMT:         308637.76 MAINTAIN
                         VMT Total:        3855393.68
Collisions
-----------
       Property-damage only (rate):      1 (   324.00) FAIL > 132.0
                   Injuries (rate):      0 (     0.00) ADVANCE < 75.0
                 Fatalities (rate):      0 (     0.00) ADVANCE < 1.33
Operations
------------
             Disengagements (rate):      0 (     0.00) No advancement performance requirement
Unplanned stops > 2 minutes (rate):     63 ( 20412.28) ADVANCE < 167000.0
Unplanned stops > 15 minutes(rate):      6 (  1944.03) ADVANCE < 17000.0
         Vehicle retrievals (rate):      1 (   324.00) ADVANCE < 3000.0
 1st responder obstructions (rate):      0 (     0.00) ADVANCE < 3000.0
```

Figure 5. Property Damage Only Collision Rates

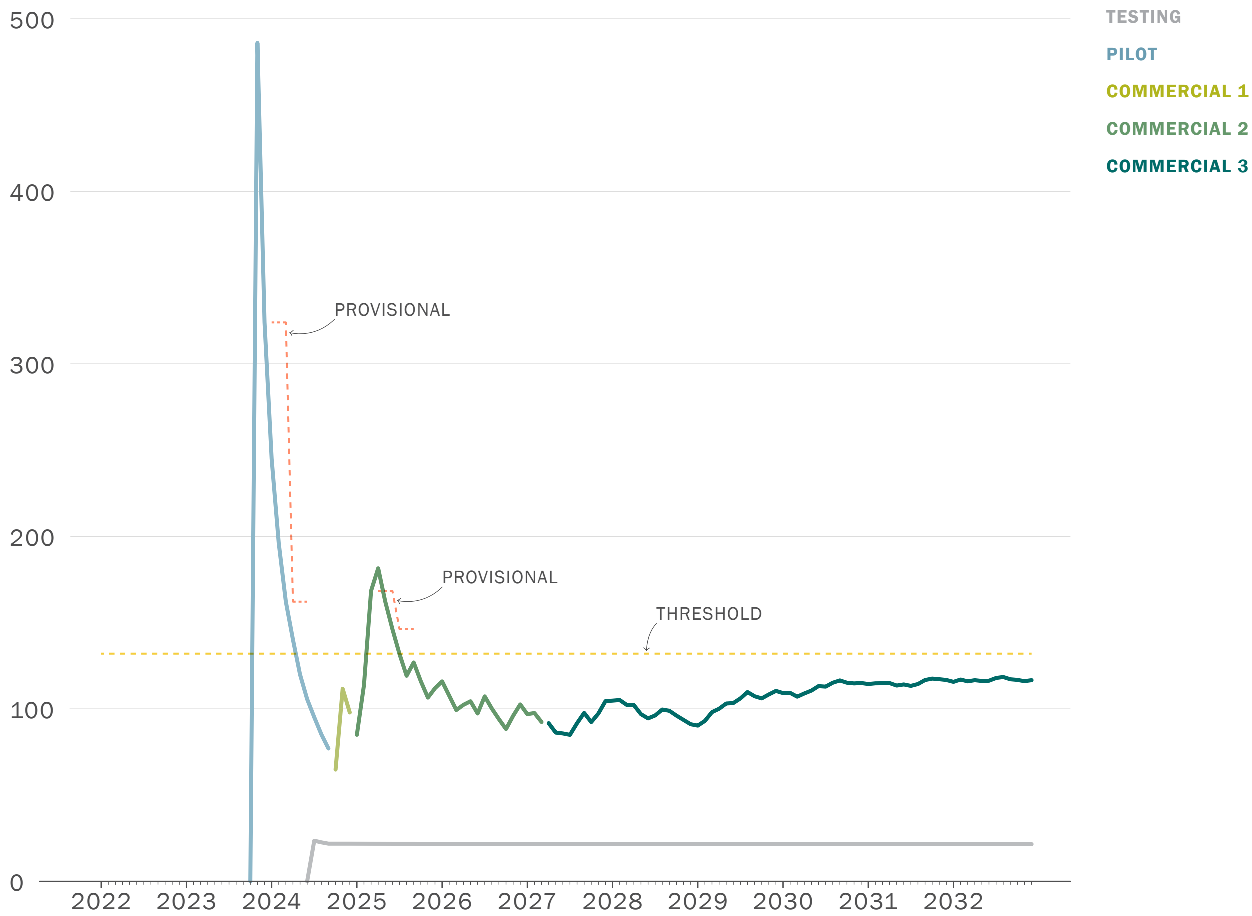


Figure 6. Pilot Phase Final Report

```
Start: 2023-10-01    Current: 2024-10-01     End: None Days elapsed: 366
Status: ADVANCE
Active vehicles: 153

Vehicle Miles Traveled
----------------------
                        Driver VMT:         653219.94
               ADS With Driver VMT:        4576492.78
            ADS Without Driver VMT:        1298635.10 ADVANCE
                         VMT Total:        6528347.83
Collisions
-----------
       Property-damage only (rate):      1 (     77.00) ADVANCE < 132.0
                   Injuries (rate):      0 (      0.00) ADVANCE < 75.0
                 Fatalities (rate):      0 (      0.00) ADVANCE < 1.33
Operations
------------
             Disengagements (rate):      0 (      0.00) No advancement performance requirement
Unplanned stops > 2 minutes (rate):    219 ( 16863.86) ADVANCE < 167000.0
Unplanned stops > 15 minutes(rate):     23 (  1771.09) ADVANCE < 17000.0
         Vehicle retrievals (rate):      4 (    308.02) ADVANCE < 3000.0
 1st responder obstructions (rate):      1 (     77.00) ADVANCE < 3000.0
```

Driverless Commercial Phase 1

Operating with 340 vehicles, Omicron moved quickly through commercial service phase 1, meeting all required thresholds and accumulating over 2 million driverless within a single quarter. By the end of Commercial Phase 1, their driverless operations had accumulated 2 property damage only collisions, 1 injury, and no fatalities. They had 4 vehicle retrieval event, 28 unplanned stop exceeding 15 minutes, and 323 unplanned stops exceeding 2 minutes (see Figure 2). During this period, they used their entire fleet for commercial operations, and did not conduct further testing with a safety driver.

Figure 7. Driverless Commercial Phase 1 Report

```
Start: 2024-10-01    Current: 2025-01-01     End: None Days elapsed: 92
Status: ADVANCE
Active vehicles: 295

Vehicle Miles Traveled
----------------------
                        Driver VMT:         653219.94
               ADS With Driver VMT:        4576492.78
            ADS Without Driver VMT:        2043279.19 ADVANCE
                         VMT Total:        7272991.92
Collisions
-----------
       Property-damage only (rate):      2 (    97.88) ADVANCE < 132.0
                   Injuries (rate):      1 (    48.94) ADVANCE < 75.0
                 Fatalities (rate):      0 (     0.00) ADVANCE < 1.33
Operations
------------
             Disengagements (rate):      0 (     0.00) No advancement performance requirement
Unplanned stops > 2 minutes (rate):    323 ( 15807.92) ADVANCE < 25000.0
Unplanned stops > 15 minutes(rate):     28 (  1370.35) ADVANCE < 2500.0
         Vehicle retrievals (rate):      4 (   195.76) ADVANCE < 400.0
 1st responder obstructions (rate):      2 (    97.88) ADVANCE < 400.0
```

Driverless Commercial Phase 2

Omicron began commercial service phase 2 in January 2025, and began to expand their fleet up to the permitted 1,700 vehicles. At the beginning of driverless commercial service phase 2, they were driving 250,000 miles per month (see Figure 8), and by the end had increased to over 1 million miles per month. They had a cluster of collisions that resulted in exceeding the property damage only collision rate threshold (see Figure 5) and injury rate threshold (see Figure 9). Both rates fell below the applicable thresholds later that year. Over this time, Omicron's rate of unplanned stops exceeding 2 minutes fell from 15,500 (above the threshold) to 12,300 (below the threshold). Omicron was permitted to advance to Commercial Phase 3 in April 2027. Had they brought down their rate of unplanned stops exceeding 2 minutes earlier, they could have advanced as early as October 2025.

Figure 8. Monthly VMT by Phase

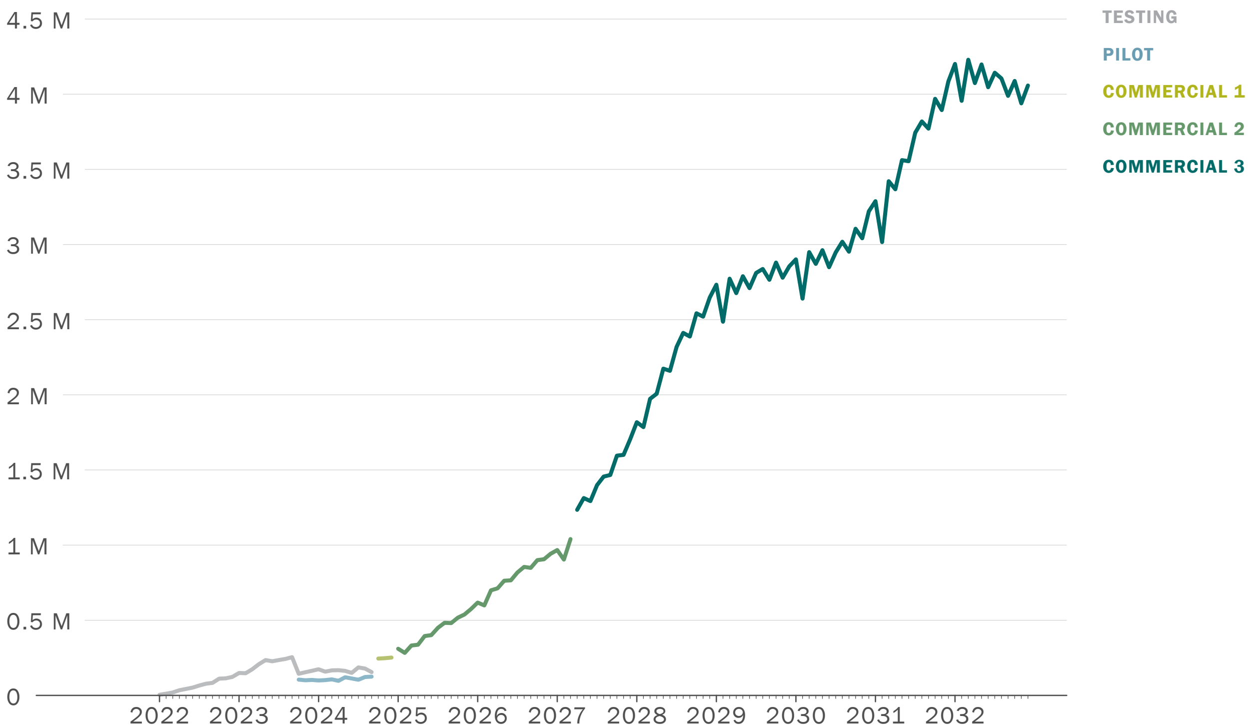


Figure 9. Injury Rates

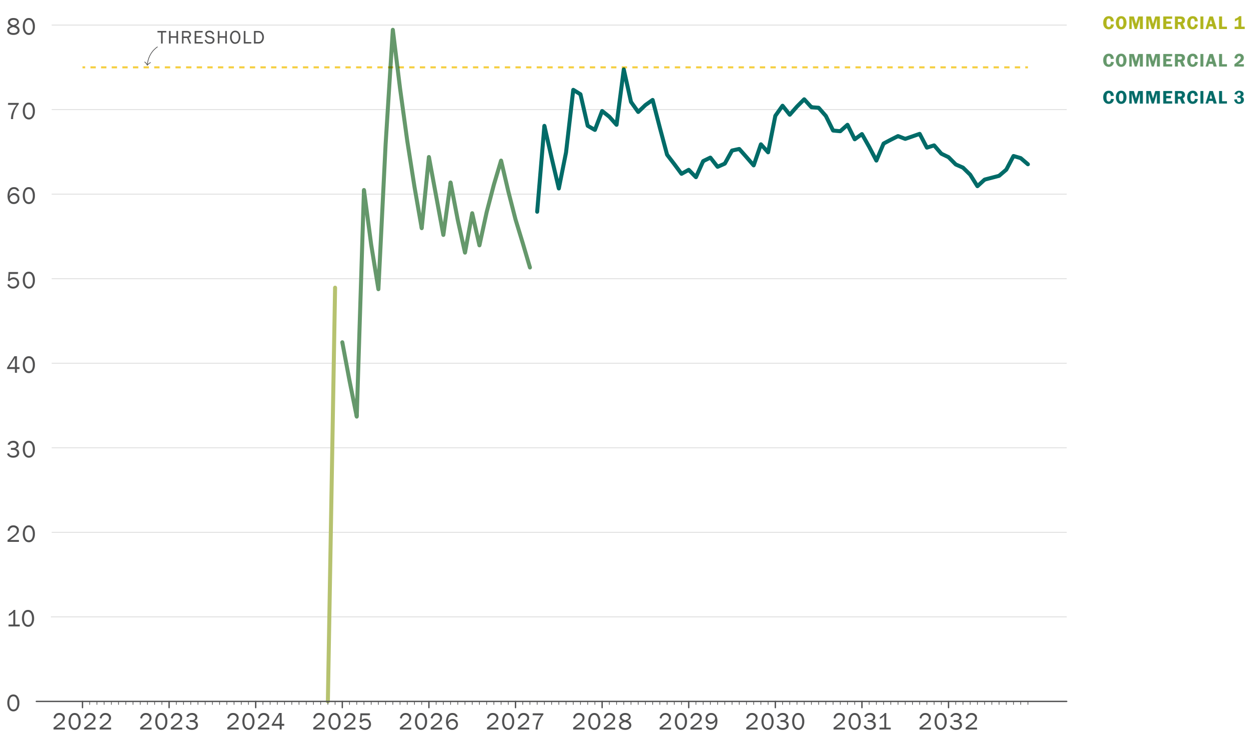


Figure 10. Commercial Phase 2 Report

```
Start: 2025-01-01    Current: 2027-04-01     End: None Days elapsed: 820
Status: ADVANCE
Active vehicles: 989

Vehicle Miles Traveled
----------------------
                        Driver VMT:         657078.90
               ADS With Driver VMT:        4609064.10
            ADS Without Driver VMT:       19484845.78 ADVANCE
                         VMT Total:       24750988.78
Collisions
-----------
       Property-damage only (rate):     18 (     92.38) ADVANCE < 132.0
                   Injuries (rate):     10 (     51.32) ADVANCE < 75.0
                 Fatalities (rate):      0 (      0.00) ADVANCE < 1.33
Operations
------------
             Disengagements (rate):      0 (      0.00) No advancement performance requirement
Unplanned stops > 2 minutes (rate):   2396 ( 12296.74) ADVANCE < 12500.0
Unplanned stops > 15 minutes(rate):     99 (    508.09) ADVANCE < 1300.0
         Vehicle retrievals (rate):     18 (     92.38) ADVANCE < 200.0
 1st responder obstructions (rate):      6 (     30.79) ADVANCE < 200.0
```

Driverless Commercial Phase 3

Omicron operated in Commercial Phase 3 from April 2027 to December 2032, the end of the simulated period. During this time they accumulated over 200 million miles. They were involved in 239 PDO collisions and collisions which resulted in 130 injuries. Omicron was not involved in any fatal collisions. They nearly 20,000 unplanned stops lasting 2 minutes or longer, 62 unplanned stops lasting 15 minutes or longer, 17 vehicle retrieval events, and 33 instances of obstructing first responders.

Overview

From January 2022 to December 2032, Omicron drove over 220 million driverless miles, and their driverless operations resulted in 257 property damage only collisions, 140 injuries, and no fatalities (See Figure 11). Their safety and operational rates stabilized below the established performance thresholds as their technology matured and the accrued more miles (see Figure 3, Figure 5, and Figure 9). By contrast the absolute number of events in some cases peaked and then began to decline (Figure 15 and Figure 16) while in other cases continued to rise (Figures 12, 13, and 14).

Figure 11. Final Commercial Phase 3 Report

```
Start: 2027-04-01    Current: 2033-01-01     End: None Days elapsed: 2102
Status: MAINTAIN
Active vehicles: 2998

Vehicle Miles Traveled
----------------------
                        Driver VMT:         660159.52
               ADS With Driver VMT:        4634878.10
            ADS Without Driver VMT:      220361754.63 No criteria
                         VMT Total:      225656792.25
Collisions
-----------
       Property-damage only (rate):    257 (   116.63) No advancement performance requirement
                   Injuries (rate):    140 (    63.53) No advancement performance requirement
                 Fatalities (rate):      0 (     0.00) No advancement performance requirement
Operations
------------
             Disengagements (rate):      0 (     0.00) No advancement performance requirement
Unplanned stops > 2 minutes (rate):  22007 (  9986.76) No advancement performance requirement
Unplanned stops > 15 minutes(rate):    161 (    73.06) No advancement performance requirement
         Vehicle retrievals (rate):     35 (    15.88) No advancement performance requirement
 1st responder obstructions (rate):     39 (    17.70) No advancement performance requirement
```

Figure 12. Property Damage Only Collisions

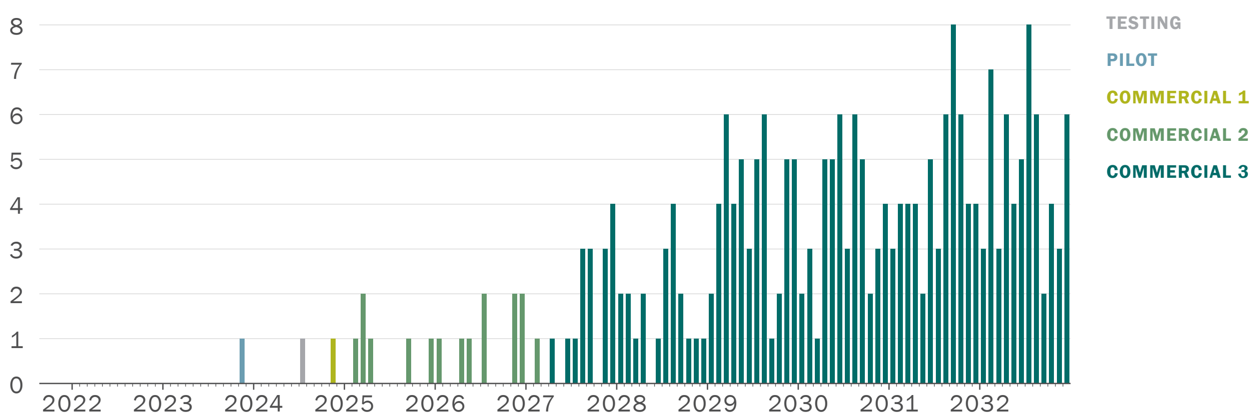


Figure 13. Injuries

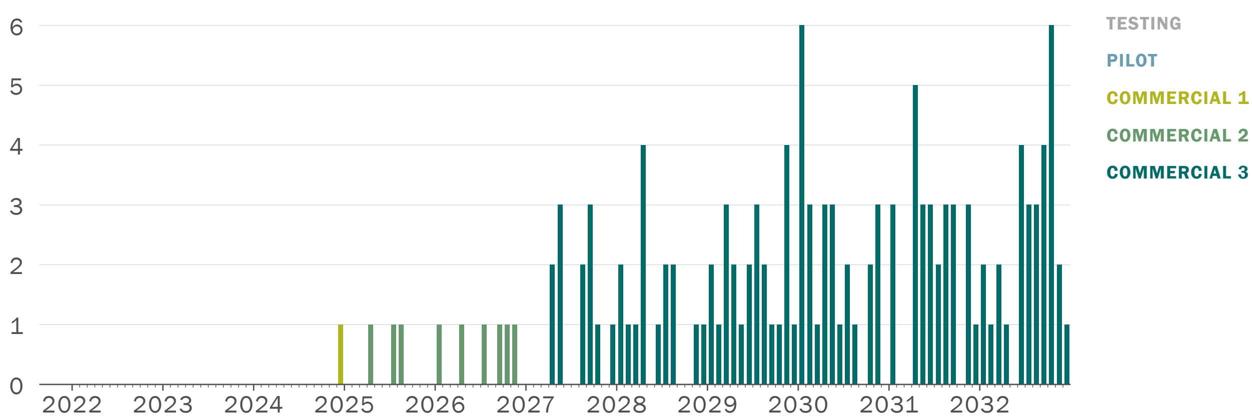


Figure 14. Unplanned Stops Exceeding 2 Minutes

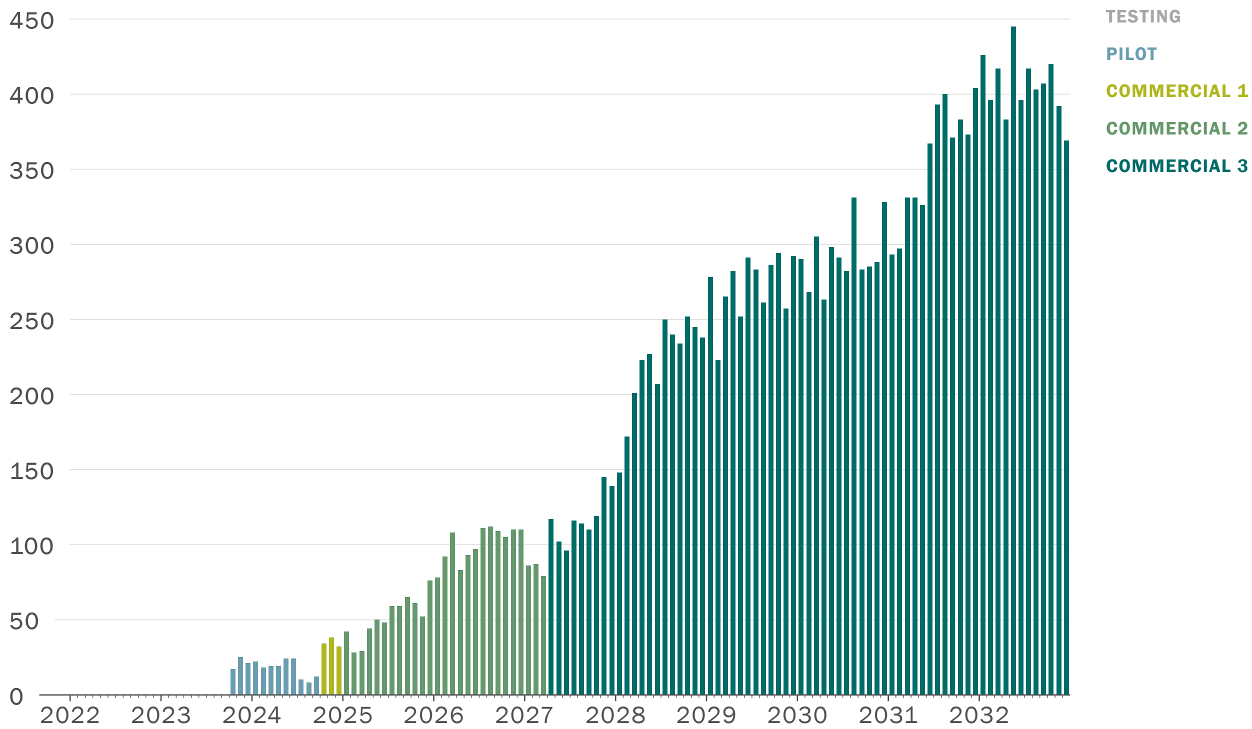


Figure 15. Unplanned Stops Exceeding 15 Minutes

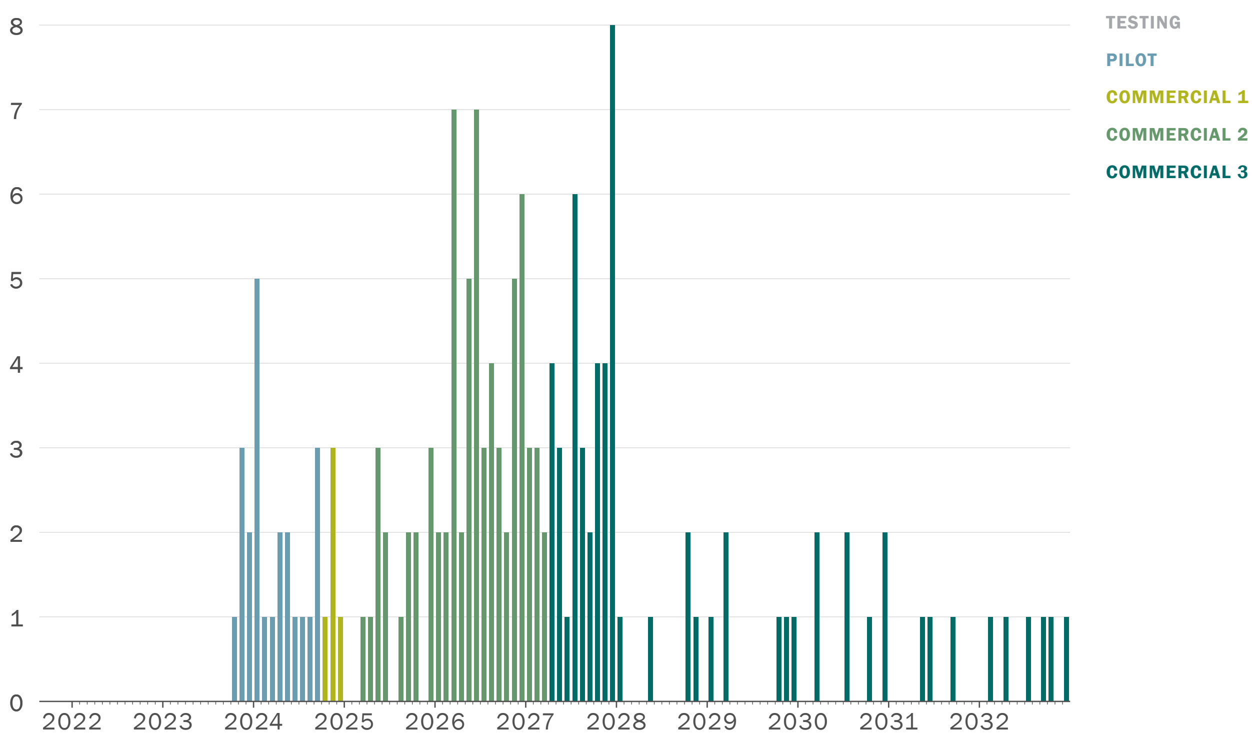
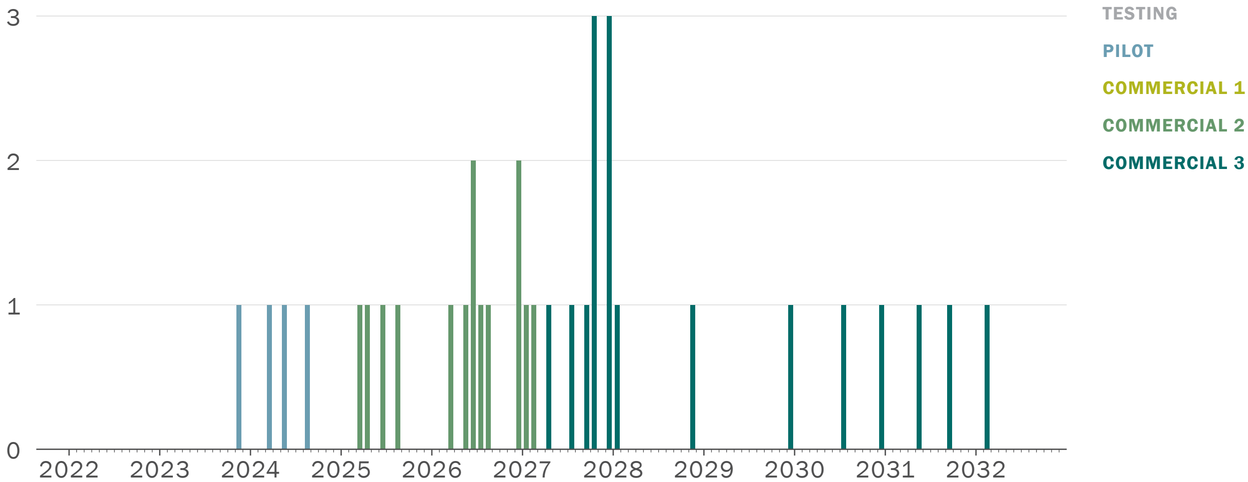


Figure 16. Vehicle Retrieval Events



Example Application Conclusion

This example demonstrates that the proposed framework provides a transparent tool to track AV performance as an AV provider advances from the testing phases to the more complex commercial driverless operations. AV service providers are held to higher standards at each successive phase, requiring them to demonstrate performance before advancing, and risking demotion into an earlier phase if they advance before they are ready. Transparent data reporting will create a meaningful feedback loop to the regulators and AV service providers, enabling them to identify and address issues as they arise. This transparency will also build confidence among the public.

6. Next Steps

The next phase of this work will aim to strengthen the conceptual framework by engaging a broader range of stakeholders, including practitioners, academics, regulators, and city officials. This collaboration will help refine the concepts presented here and improve their applicability and effective for real-world contexts.

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APPENDIX A

Data Templates and Examples

Table A-1. VMT Report Template

FIELD	DESCRIPTION
vin	Vehicle identification number
company	AV passenger service operator
phase	Phase of testing or deployment
dmv_permit_id	DMV permit ID number
cpuc_permit_id	CPUC permit ID number
year	Year
month	Month
city	City
county	County
vmt_total	Total VMT
vmt_driver	VMT driven by a human driver
vmt_ads_with_driver	VMT driven by an automated driving system with a backup human safety driver present
vmt_ads_no_driver	VMT driven by an automated driving system without a backup human safety driver present

Table A-2. Disengagement Report Template

FIELD	DESCRIPTION
vin	Vehicle identification number
company	AV passenger service operator
phase	Phase of testing or deployment
dmv_permit_id	DMV permit ID number
cpuc_permit_id	CPUC permit ID number
county	County
city	City
timestamp	Date and time in Coordinated Universal Time (UTC)
lat	Latitude
lon	Longitude

Table A-3. Unplanned Stop Report

FIELD	DESCRIPTION
vin	Vehicle identification number
company	AV passenger service operator
phase	Phase of testing or deployment
dmv_permit_id	DMV permit ID number
cpuc_permit_id	CPUC permit ID number
county	County
city	City
timestamp	Date and time in Coordinated Universal Time (UTC)
lat	Latitude
lon	Longitude
in_gp_lane	1 if any part of the vehicle is occupying a GP lane, 0 otherwise
in_bus_lane	1 if any part of the vehicle is occupying a bus lane, 0 otherwise
in_bike_lane	1 if any part of the vehicle is occupying a bike line, 0 otherwise
on_rail_track	1 if any part of the vehicle is in the path of a rail vehicle, 0 otherwise
vehicle_retrieval	1 if the event ended with the vehicle being towed or driven away by a human driver
first_responder_obstruction	1 if the event obstructed an ambulance, firetruck, police vehicle, or other emergency or first-responder vehicle
duration	Duration of the stop in seconds

Table A-4. VMT Report Example

VIN	COMPANY	PHASE	DMV_PERMIT_ID	CPUC_PERMIT_ID	YEAR	MONTH	CITY	COUNTY	VMT_TOTAL	VMT_DRIVER	VMT_ADS_WITH_DRIVER	VMT_ADS_NO_DRIVER
1A40VPCV082434074	Omicron	commercial_3	DMV00032	CPUC00033	2029	9	San Francisco	San Francisco	158.59	0	0	158.59
1A40VPCV082434074	Omicron	commercial_3	DMV00032	CPUC00033	2029	10	San Francisco	San Francisco	1238.38	0	0	1238.38
1A40VPCV082434074	Omicron	commercial_3	DMV00032	CPUC00033	2029	11	San Francisco	San Francisco	1301.19	0	0	1301.19
1A40VPCV082434074	Omicron	commercial_3	DMV00032	CPUC00033	2029	12	San Francisco	San Francisco	1345.93	0	0	1345.93
1A40VPCV082434074	Omicron	commercial_3	DMV00032	CPUC00033	2030	1	San Francisco	San Francisco	1311.18	0	0	1311.18
1A40VPCV082434074	Omicron	commercial_3	DMV00032	CPUC00033	2030	2	San Francisco	San Francisco	1248.50	0	0	1248.50
1A40VPCV082434074	Omicron	commercial_3	DMV00032	CPUC00033	2030	3	San Francisco	San Francisco	1359.42	0	0	1359.42
1A40VPCV082434074	Omicron	commercial_3	DMV00032	CPUC00033	2030	4	San Francisco	San Francisco	1420.13	0	0	1420.13
1A40VPCV082434074	Omicron	commercial_3	DMV00032	CPUC00033	2030	5	San Francisco	San Francisco	1478.56	0	0	1478.56
1A40VPCV082434074	Omicron	commercial_3	DMV00032	CPUC00033	2030	6	San Francisco	San Francisco	1181.57	0	0	1181.57
1A40VPCV082434074	Omicron	commercial_3	DMV00032	CPUC00033	2030	7	San Francisco	San Francisco	1409.28	0	0	1409.28
1A40VPCV082434074	Omicron	commercial_3	DMV00032	CPUC00033	2030	8	San Francisco	San Francisco	1338.72	0	0	1338.72
1A40VPCV082434074	Omicron	commercial_3	DMV00032	CPUC00033	2030	9	San Francisco	San Francisco	1164.10	0	0	1164.10
1A40VPCV082434074	Omicron	commercial_3	DMV00032	CPUC00033	2030	10	San Francisco	San Francisco	1490.93	0	0	1490.93
1A40VPCV082434074	Omicron	commercial_3	DMV00032	CPUC00033	2030	11	San Francisco	San Francisco	1217.89	0	0	1217.89
1A40VPCV082434074	Omicron	commercial_3	DMV00032	CPUC00033	2030	12	San Francisco	San Francisco	1336.19	0	0	1336.19
1A40VPCV082434074	Omicron	commercial_3	DMV00032	CPUC00033	2031	1	San Francisco	San Francisco	1183.48	0	0	1183.48
1A40VPCV082434074	Omicron	commercial_3	DMV00032	CPUC00033	2031	2	San Francisco	San Francisco	1099.45	0	0	1099.45
1A40VPCV082434074	Omicron	commercial_3	DMV00032	CPUC00033	2031	3	San Francisco	San Francisco	1407.42	0	0	1407.42
1A40VPCV082434074	Omicron	commercial_3	DMV00032	CPUC00033	2031	4	San Francisco	San Francisco	1269.48	0	0	1269.48
1A40VPCV082434074	Omicron	commercial_3	DMV00032	CPUC00033	2031	5	San Francisco	San Francisco	1252.95	0	0	1252.95
1A40VPCV082434074	Omicron	commercial_3	DMV00032	CPUC00033	2031	6	San Francisco	San Francisco	1288.89	0	0	1288.89
1A40VPCV082434074	Omicron	commercial_3	DMV00032	CPUC00033	2031	7	San Francisco	San Francisco	1362.56	0	0	1362.56
1A40VPCV082434074	Omicron	commercial_3	DMV00032	CPUC00033	2031	8	San Francisco	San Francisco	1480.09	0	0	1480.09
1A40VPCV082434074	Omicron	commercial_3	DMV00032	CPUC00033	2031	9	San Francisco	San Francisco	1254.84	0	0	1254.84
1A40VPCV082434074	Omicron	commercial_3	DMV00032	CPUC00033	2031	10	San Francisco	San Francisco	1341.48	0	0	1341.48
1A40VPCV082434074	Omicron	commercial_3	DMV00032	CPUC00033	2031	11	San Francisco	San Francisco	1309.70	0	0	1309.70
1A40VPCV082434074	Omicron	commercial_3	DMV00032	CPUC00033	2031	12	San Francisco	San Francisco	1468.41	0	0	1468.41
1A40VPCV082434074	Omicron	commercial_3	DMV00032	CPUC00033	2032	1	San Francisco	San Francisco	1404.52	0	0	1404.52
1A40VPCV082434074	Omicron	commercial_3	DMV00032	CPUC00033	2032	2	San Francisco	San Francisco	1288.26	0	0	1288.26
1A40VPCV082434074	Omicron	commercial_3	DMV00032	CPUC00033	2032	3	San Francisco	San Francisco	1251.09	0	0	1251.09
1A40VPCV082434074	Omicron	commercial_3	DMV00032	CPUC00033	2032	4	San Francisco	San Francisco	1234.97	0	0	1234.97

Table A-5. Disengagement Report Example

VIN	COMPANY	PHASE	DMV_PERMIT_ID	CPUC_PERMIT_ID	COUNTY	CITY	TIMESTAMP	LAT	LON
KNMT562639G271674	Omicron	testing	DMV00030	None	San Francisco	San Francisco	2032-03-13T15:09:29Z	37.72908786	-122.542675
KNMT562639G271674	Omicron	testing	DMV00030	None	San Francisco	San Francisco	2032-06-09T22:17:27Z	37.77445578	-122.4860209
LYVDR4SZ9K5534872	Omicron	testing	DMV00030	None	San Francisco	San Francisco	2022-01-25T14:40:45Z	37.72654014	-122.4732428
LYVDR4SZ9K5534872	Omicron	testing	DMV00030	None	San Francisco	San Francisco	2022-02-14T18:52:58Z	37.79270151	-122.5898753
LYVDR4SZ9K5534872	Omicron	testing	DMV00030	None	San Francisco	San Francisco	2022-03-29T21:43:57Z	37.75380135	-122.4172918
LYVDR4SZ9K5534872	Omicron	testing	DMV00030	None	San Francisco	San Francisco	2022-04-01T12:50:14Z	37.78013623	-122.5494776
LYVDR4SZ9K5534872	Omicron	testing	DMV00030	None	San Francisco	San Francisco	2022-05-23T23:56:47Z	37.77924623	-122.4061459
LYVDR4SZ9K5534872	Omicron	testing	DMV00030	None	San Francisco	San Francisco	2022-05-31T18:24:33Z	37.78912015	-122.5919029
LYVDR4SZ9K5534872	Omicron	testing	DMV00030	None	San Francisco	San Francisco	2022-07-07T08:08:09Z	37.74992645	-122.4716263
NFB428VL620312771	Omicron	testing	DMV00030	None	San Francisco	San Francisco	2022-02-02T19:48:17Z	37.78963587	-122.5895678
NFB428VL620312771	Omicron	testing	DMV00030	None	San Francisco	San Francisco	2022-03-29T23:44:19Z	37.78016545	-122.5285855
NFB428VL620312771	Omicron	testing	DMV00030	None	San Francisco	San Francisco	2022-04-09T17:40:47Z	37.7697676	-122.4462013
NFB428VL620312771	Omicron	testing	DMV00030	None	San Francisco	San Francisco	2022-04-28T06:07:04Z	37.78734728	-122.6534396
NFB428VL620312771	Omicron	testing	DMV00030	None	San Francisco	San Francisco	2022-05-29T19:27:44Z	37.78678603	-122.4119954
NFB428VL620312771	Omicron	testing	DMV00030	None	San Francisco	San Francisco	2022-06-01T12:20:18Z	37.77694394	-122.6679641
NFB428VL620312771	Omicron	testing	DMV00030	None	San Francisco	San Francisco	2022-08-31T19:26:21Z	37.78374425	-122.5079374
VSK4GNGX0N1329004	Omicron	testing	DMV00030	None	San Francisco	San Francisco	2022-02-18T07:53:07Z	37.77885479	-122.5171663
VSK4GNGX0N1329004	Omicron	testing	DMV00030	None	San Francisco	San Francisco	2022-02-23T15:05:15Z	37.79351208	-122.5044698
VSK4GNGX0N1329004	Omicron	testing	DMV00030	None	San Francisco	San Francisco	2022-02-28T12:38:54Z	37.78327491	-122.4522674
VSK4GNGX0N1329004	Omicron	testing	DMV00030	None	San Francisco	San Francisco	2022-03-02T17:12:51Z	37.79083979	-122.522424
VSK4GNGX0N1329004	Omicron	testing	DMV00030	None	San Francisco	San Francisco	2022-03-18T18:20:42Z	37.79075968	-122.4599065
VSK4GNGX0N1329004	Omicron	testing	DMV00030	None	San Francisco	San Francisco	2022-05-01T16:09:06Z	37.79336347	-122.6269946
VSK4GNGX0N1329004	Omicron	testing	DMV00030	None	San Francisco	San Francisco	2022-08-19T16:56:06Z	37.73284718	-122.4750582
VSK4GNGX0N1329004	Omicron	testing	DMV00030	None	San Francisco	San Francisco	2022-08-26T05:33:06Z	37.78788699	-122.5048926
VSK4GNGX0N1329004	Omicron	testing	DMV00030	None	San Francisco	San Francisco	2022-09-02T17:35:08Z	37.76776526	-122.595861
VSK4GNGX0N1329004	Omicron	testing	DMV00030	None	San Francisco	San Francisco	2022-10-13T21:17:40Z	37.74325393	-122.5360168
VSK4GNGX0N1329004	Omicron	testing	DMV00030	None	San Francisco	San Francisco	2022-10-22T09:33:03Z	37.75805826	-122.5087512
VSK4GNGX0N1329004	Omicron	testing	DMV00030	None	San Francisco	San Francisco	2022-11-10T14:34:42Z	37.75189938	-122.6279204
7JRW5WCG3KS826325	Omicron	testing	DMV00030	None	San Francisco	San Francisco	2022-02-05T15:32:54Z	37.74307933	-122.5810294
7JRW5WCG3KS826325	Omicron	testing	DMV00030	None	San Francisco	San Francisco	2022-02-26T15:22:51Z	37.79484452	-122.4310456
7JRW5WCG3KS826325	Omicron	testing	DMV00030	None	San Francisco	San Francisco	2022-04-07T18:09:52Z	37.7613847	-122.6018284
7JRW5WCG3KS826325	Omicron	testing	DMV00030	None	San Francisco	San Francisco	2022-04-23T18:22:35Z	37.72681114	-122.5967837

Table A-6. Unplanned Stop Report Example

VIN	COMPANY	PHASE	DMV_PERMIT_ID	CPUC_PERMIT_ID	COUNTY	CITY	TIMESTAMP	LAT	LON	IN_GP_LANE	IN_BUS_LANE	IN_BIKE_LANE	ON_RAIL_TRACK	VEHICLE_RETRIEVAL	FIRST_RESPONDER_OBSTRUCTION	DURATION
JTHACMRPXTY796263	Omicron	commercial_3	DMV00032	CPUC00033	San Francisco	San Francisco	2032-12-26T23:03:02Z	37.75655129	-122.4067191	0	0	0	0	0	0	4.29
XW859Z2W75Z061449	Omicron	commercial_3	DMV00032	CPUC00033	San Francisco	San Francisco	2032-12-16T21:31:29Z	37.7826109	-122.407227	1	0	0	0	0	0	2.91
9GAP4KMT3RM061135	Omicron	commercial_3	DMV00032	CPUC00033	San Francisco	San Francisco	2032-12-14T23:36:26Z	37.71803852	-122.4679715	1	0	0	0	0	0	9.96
JAE9A2KH87S465441	Omicron	commercial_3	DMV00032	CPUC00033	San Francisco	San Francisco	2032-12-26T21:14:55Z	37.78967245	-122.4079982	1	0	1	0	0	0	3.36
JT8HH14Y3E7227195	Omicron	commercial_3	DMV00032	CPUC00033	San Francisco	San Francisco	2032-12-15T22:33:42Z	37.75273583	-122.4612034	1	0	0	0	0	0	6.62
VSKMJRVH8GR733869	Omicron	commercial_3	DMV00032	CPUC00033	San Francisco	San Francisco	2032-12-04T21:51:56Z	37.78859929	-122.4317611	1	0	0	0	0	0	9.63
WB5WBLM59DS079797	Omicron	commercial_3	DMV00032	CPUC00033	San Francisco	San Francisco	2032-11-27T00:28:37Z	37.78151691	-122.429094	1	0	0	0	0	0	6.49
9371SWT34ND081175	Omicron	commercial_3	DMV00032	CPUC00033	San Francisco	San Francisco	2032-11-28T21:51:42Z	37.75592807	-122.605527	1	0	0	0	0	0	3.02
W08JYWSYXLL254068	Omicron	commercial_3	DMV00032	CPUC00033	San Francisco	San Francisco	2032-12-25T21:50:30Z	37.72792499	-122.6316737	1	0	0	0	0	0	10.99
LVYJ4C2H360041446	Omicron	commercial_3	DMV00032	CPUC00033	San Francisco	San Francisco	2032-11-22T21:28:52Z	37.77307708	-122.5477233	1	0	0	0	0	0	5.51
3A4JAHPA1AP663437	Omicron	commercial_3	DMV00032	CPUC00033	San Francisco	San Francisco	2032-12-27T21:10:20Z	37.7414588	-122.4336098	1	0	0	0	0	0	4.14
NC0A2B6K1DK631573	Omicron	commercial_3	DMV00032	CPUC00033	San Francisco	San Francisco	2032-10-16T22:20:24Z	37.77430439	-122.5111114	1	0	0	0	0	0	6.15
9BV9WNJN8PG827768	Omicron	commercial_3	DMV00032	CPUC00033	San Francisco	San Francisco	2032-11-04T22:15:48Z	37.76174858	-122.5859872	1	0	0	0	0	0	1.96
NMTDT8T00HK531542	Omicron	commercial_3	DMV00032	CPUC00033	San Francisco	San Francisco	2032-10-09T22:34:34Z	37.7909341	-122.4988251	1	0	0	0	0	0	5.11
NMTDT8T00HK531542	Omicron	commercial_3	DMV00032	CPUC00033	San Francisco	San Francisco	2032-11-04T03:04:54Z	37.78517536	-122.6140846	1	1	0	0	0	0	3.93
NMTDT8T00HK531542	Omicron	commercial_3	DMV00032	CPUC00033	San Francisco	San Francisco	2032-12-24T21:38:11Z	37.77678214	-122.4405881	1	0	1	0	0	0	3.40
4G1CBK982PL965020	Omicron	commercial_3	DMV00032	CPUC00033	San Francisco	San Francisco	2032-12-04T23:24:50Z	37.7410294	-122.5714009	1	1	0	0	0	0	4.26
MEE37YN40MG306437	Omicron	commercial_3	DMV00032	CPUC00033	San Francisco	San Francisco	2032-10-04T21:41:18Z	37.78594707	-122.5193814	1	0	0	0	0	0	7.48
MEE37YN40MG306437	Omicron	commercial_3	DMV00032	CPUC00033	San Francisco	San Francisco	2032-11-30T21:51:28Z	37.78841439	-122.475631	1	0	0	0	0	0	4.70
6T1K93ELXLR799093	Omicron	commercial_3	DMV00032	CPUC00033	San Francisco	San Francisco	2032-10-09T23:41:21Z	37.77913774	-122.5171875	1	0	0	0	0	0	8.73
AFB1VXH83WF109925	Omicron	commercial_3	DMV00032	CPUC00033	San Francisco	San Francisco	2032-10-01T21:19:23Z	37.7487027	-122.3988329	1	0	0	0	0	0	6.74
4VABVJGE5J8373573	Omicron	commercial_3	DMV00032	CPUC00033	San Francisco	San Francisco	2032-10-31T22:54:05Z	37.75100431	-122.4287489	1	0	0	0	0	0	3.98
YC186SCD88P455908	Omicron	commercial_3	DMV00032	CPUC00033	San Francisco	San Francisco	2032-11-12T21:09:37Z	37.75393133	-122.5052366	1	0	1	0	0	0	5.16
VGAS1B3G13X345304	Omicron	commercial_3	DMV00032	CPUC00033	San Francisco	San Francisco	2032-10-06T21:55:19Z	37.75683354	-122.5512859	1	0	0	0	0	0	6.01
VGAS1B3G13X345304	Omicron	commercial_3	DMV00032	CPUC00033	San Francisco	San Francisco	2032-12-07T21:40:11Z	37.72538683	-122.4157719	1	0	0	0	0	0	3.54
8AWGREHB6PY703811	Omicron	commercial_3	DMV00032	CPUC00033	San Francisco	San Francisco	2032-10-09T22:10:29Z	37.76679083	-122.4318054	1	0	0	0	0	0	4.26
MECZ5AGH54F667281	Omicron	commercial_3	DMV00032	CPUC00033	San Francisco	San Francisco	2032-10-27T21:16:06Z	37.7920317	-122.4498376	1	0	0	0	0	0	6.47
MECZ5AGH54F667281	Omicron	commercial_3	DMV00032	CPUC00033	San Francisco	San Francisco	2032-11-16T22:21:06Z	37.7847513	-122.4806867	1	0	0	0	0	0	4.22
5UM1JZ0T95V669471	Omicron	commercial_3	DMV00032	CPUC00033	San Francisco	San Francisco	2032-09-20T22:21:47Z	37.78438109	-122.4510515	1	0	0	0	0	0	4.77
5UM1JZ0T95V669471	Omicron	commercial_3	DMV00032	CPUC00033	San Francisco	San Francisco	2032-11-06T22:44:29Z	37.78431568	-122.406854	1	0	0	0	0	0	6.48
YV1AH29NXN6443360	Omicron	commercial_3	DMV00032	CPUC00033	San Francisco	San Francisco	2032-10-22T22:14:58Z	37.72426209	-122.6071279	1	1	0	0	0	0	6.65

San Francisco
County Transportation
Authority

BD090925 RESOLUTION NO. 26-XX

RESOLUTION APPROVING THE CONCEPTUAL SAFETY-FOCUSED AUTONOMOUS VEHICLE PERMITTING FRAMEWORK AS DEVELOPED BY THE SAN FRANCISCO COUNTY TRANSPORTATION AUTHORITY

WHEREAS, San Francisco has been at the forefront of innovation in transportation technology, including early adoption various new mobility services on public streets; and

WHEREAS, Senate Bill 1298 (Padilla) authorized the California Department of Motor Vehicles (DMV) to adopt regulations for the testing and deployment of autonomous vehicles (AVs) on public roads, resulting in state-level testing rules issued in 2014 and deployment rules in 2018; and

WHEREAS, The California Public Utilities Commission (CPUC) adopted rules for AV passenger service pilots beginning in 2018 and expanded regulations to address commercial services in 2020 and 2021; and

WHEREAS, San Francisco has become a focal point for AV testing and commercial activity, with companies such as Waymo, Zoox and Apollo, operating on local streets, and Cruise having operated on local streets for years; and

WHEREAS, In December 2022, the San Francisco Board of Supervisors adopted Resolution No. 529-22 (File No. 221212), which declared the City's official AV policy, emphasizing the importance of public safety, Vision Zero, transparent data reporting, equity, and local authority in influencing AV operations through permitting, incentives, and oversight; and

WHEREAS, Resolution No. 529-22 also recognized the importance of managing AV impacts on street space, congestion, and vulnerable road users, and the need for City agencies to condition support for AV services on strong safety and equity performance; and

WHEREAS, Building on the Board of Supervisors' guidance, the San Francisco County Transportation Authority (Transportation Authority) and the San Franscisco

Municipal Transportation Agency (SFMTA) have advocated to the DMV and the CPUC for increased transparency, the adoption of performance standards, and the incremental deployment of AVs; however, these recommendations have not yet been adopted by state regulators; and

WHEREAS, In December 2023, the Transportation Authority Board directed staff to develop a report advancing the idea of incremental, performance-based permitting for advising future regulatory and policy making processes; and

WHEREAS, After consulting with practitioners and academics, Transportation Authority staff have developed such a report (Attachmen1) proposing a conceptual framework for AV permitting that incorporates incremental, performance-based permitting, which, if implemented would help increase transparency and mitigate the safety and operational risks of AV operations in cities like San Francisco; now, therefore; and

WHEREAS, At its September 3, 2025 meeting, the Community Advisory Committee was briefed on the Conceptual Safety-Focused AV Permitting Framework Report and adopted a motion of support for the staff recommendation; now, therefore, be it

RESOLVED, That the Transportation Authority hereby approves the Conceptual Safety-Focused Autonomous Vehicle Permitting Framework Report.

Attachment:

1. Conceptual Safety-Focused Autonomous Vehicle Permitting Framework Report