

San Francisco's Experience with Driverless AVs



San Francisco
County Transportation
Authority



SFMTA



SFCTA Board Meeting
October 24, 2023

Background

San Francisco's Experience with Driverless AVs

Local Context

Many competing uses for available road space

- Population density is 2nd only to NYC
- Limited road space

SF Mobility Priorities

- Transit First
- Vision Zero
- Equity & Accessibility
- Climate







SF Policy for Integrating New Mobility



SF Principles for Emerging Mobility & Tech (2017)

1. Safety
2. Transit
3. Sustainability
4. Collaboration
5. Equitable Access
6. Labor
7. Congestion
8. Financial Impact
9. Accountability
10. Disabled Access

AV Regulatory Framework

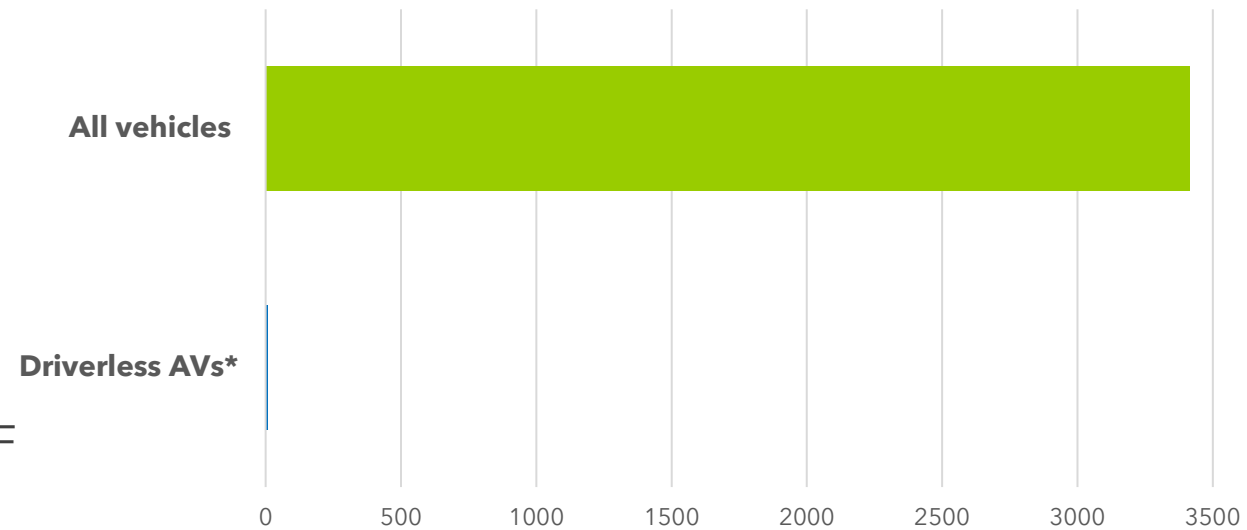
Federal	California		Local
 <ul style="list-style-type: none"> • NHTSA establishes, monitors, enforces vehicle safety standards • Issues permits for AV use • Requires AV crash reports • No comprehensive Federal policy/ framework on AVs 	 <ul style="list-style-type: none"> • CA DMV permits drivers and vehicles to operate in CA roadways • 2014 drivered testing regulations • 2018 driverless testing & deployment 	 <ul style="list-style-type: none"> • CPUC permits commercial passenger services • 2018 pilot programs for drivered & driverless passenger service • 2020 drivered & driverless deployment 	 <ul style="list-style-type: none"> • No local permitting authority • SFMTA manages ROW, including both roadways and curbs • SFCTA is Congestion Management Agency • Dec 2022 Board of Supervisors Resolution re SF AV Policy

Evolution of AV Sector

- CA has a very active AV sector
 - 40 companies testing with or without drivers
 - 4 approved for driverless deployment
 - SF is the locus of driverless AV activity
- In 2022, there were 7M driverless AV miles in SF
 - 0.2% of all VMT in SF in 2022
 - Media reports: 5M miles per company to date in SF
- Sector success requires more mature technology, regulations
 - Leveraging lessons from real-world experience
 - Addressing regulatory gaps

Estimated San Francisco Vehicle Miles Traveled (millions)

Dec 2021 - November 2022



Sources:
SFCTA data for All Vehicle VMT 2022
DMV data for Cruise & Waymo VMT 2022
*assumed to be driven entirely in SF

Driverless AV Operations

San Francisco's Experience with Driverless AVs

Role of AVs in improving street safety?

Reasons for Safety Optimism:

- Combination of cameras, lidar & radar in good repair should be superior to human perception
- AVs show many good driving practices, including, critically, compliance with posted speed limits
- If AVs lower ambient speed levels on high injury network, this could improve outcomes
- An AV fleet shares a single driver so as fleets grow in size, both good driving & driving errors may multiply on our streets
- Measuring AV safety impacts is complex and results are still uncertain

Remaining Concerns:

- AV driving could replace use of safer & > efficient modes (transit, walk, bike)
- Engineering may favor customer preferences over safety in:
 - Pick up & drop off sites
 - Speed / yielding to others
- AVs don't always comply with rules of the road, as regulators expected

Is focus on serious injury crashes enough to measure & predict AV safety now?

Too early for definitive statistical conclusions about AV crashes

Safe systems approach requires broader analysis:

that creates new hazards affecting use of safe & > efficient modes
(transit, walking, biking)

that results in less significant crashes

that results in near misses (i.e. no crash)

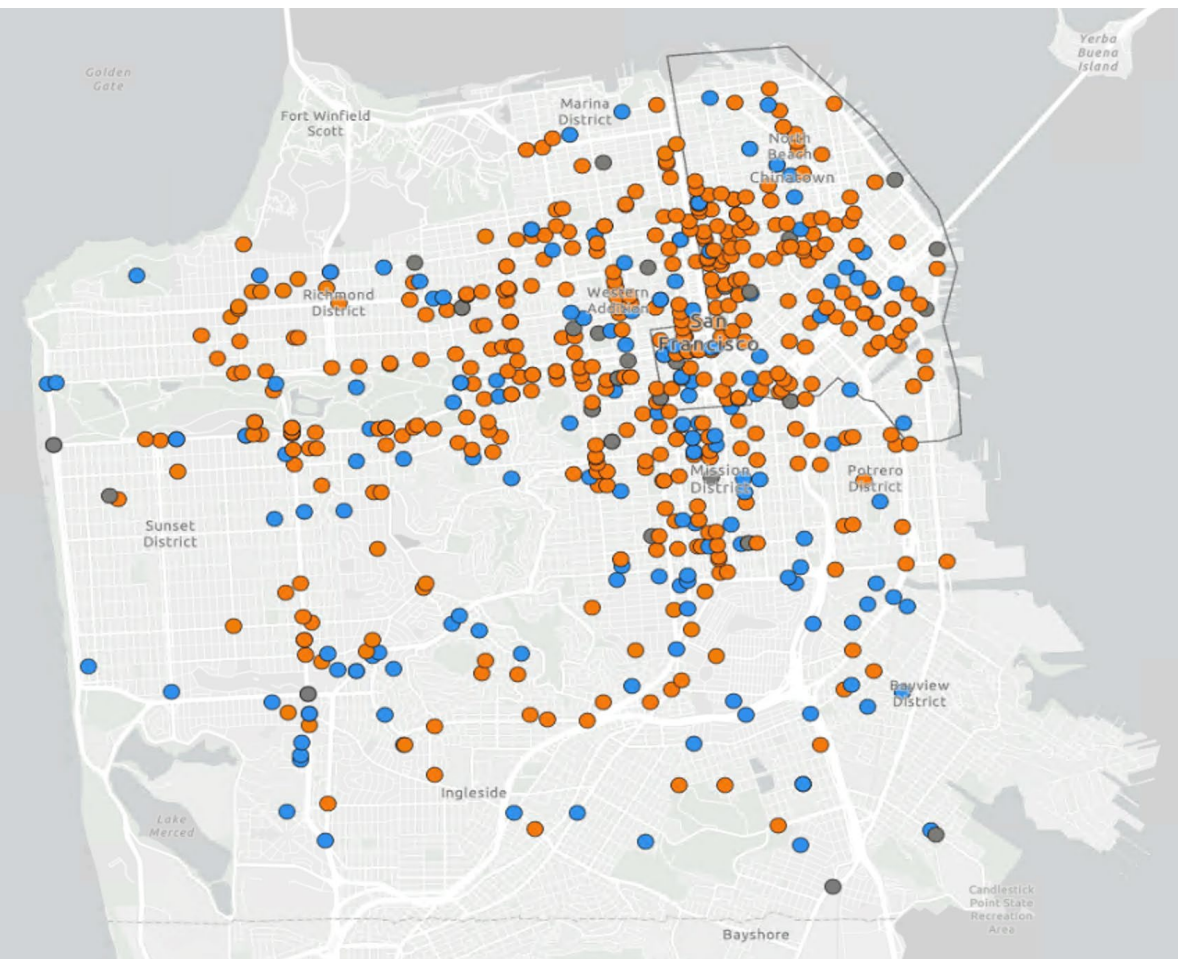
that interferes with emergency response

that interferes with essential street work



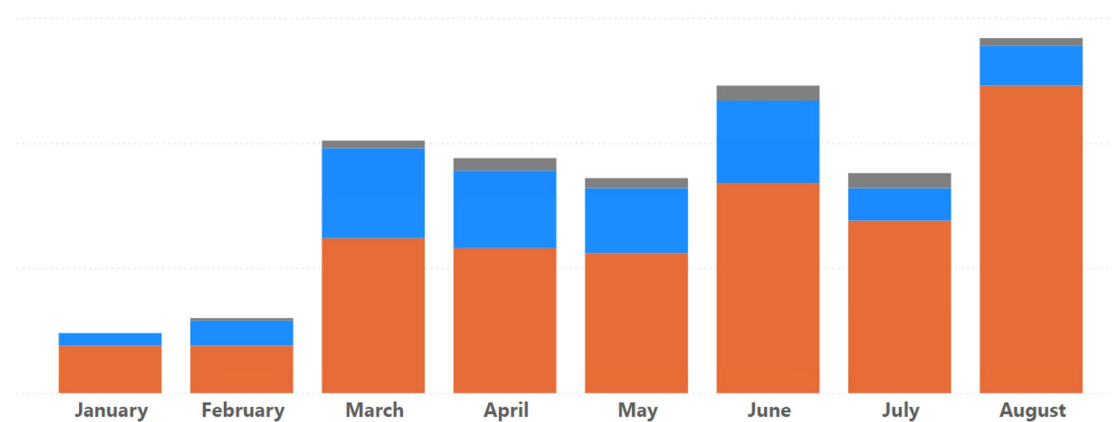
Reported incidents: which are red flags?

● Cruise ● Waymo ● Other



January – August 2023. Report Sources:
Public calls to 911 , City staff reports, media & social media

2023 Incidents by Month



Primary Incident Types:

- Erratic driving such as failure to yield
- Unplanned stops in travel lanes, including
 - Interference with safer & > efficient modes
 - Interference with street workers
 - Interference with emergency response

AV interactions with pedestrians*

* NHTSA launched preliminary safety investigation of these & other Cruise AV pedestrian interactions on 10-16-2023

6/24/2023 (Stockton @Lombard)



Interactions like these are not captured by state or federal AV safety data collection



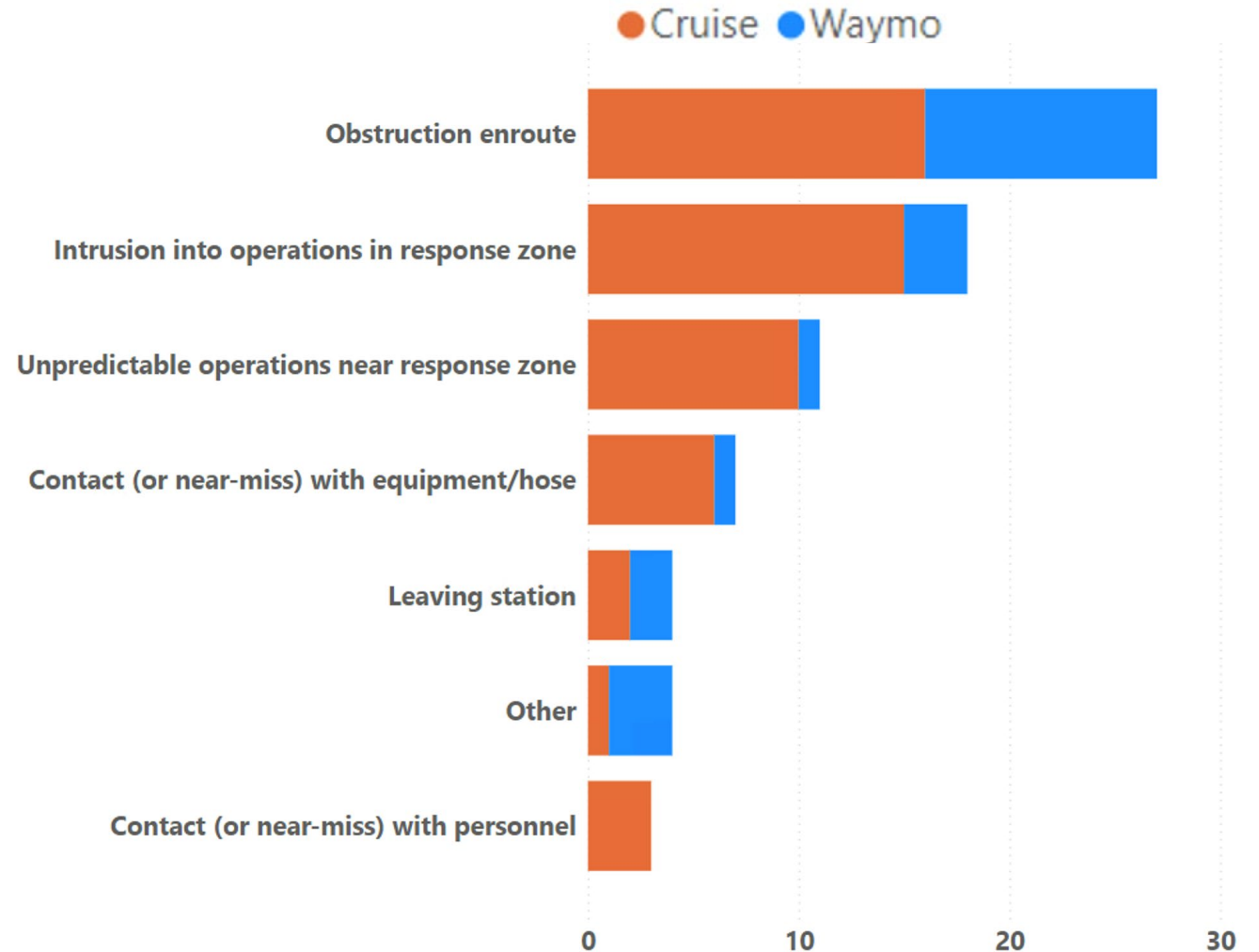
**None of these incidents
are captured by state or
federal data collection**



AV driving that interferes with emergency response



Emergency Response (SFFD) Impact Incidents by Type (Jan 1 – Sept 27, 2023)



Recent engagement on driverless AV emergency response interference

SFFD-SFPD-SFMTA requests to industry:

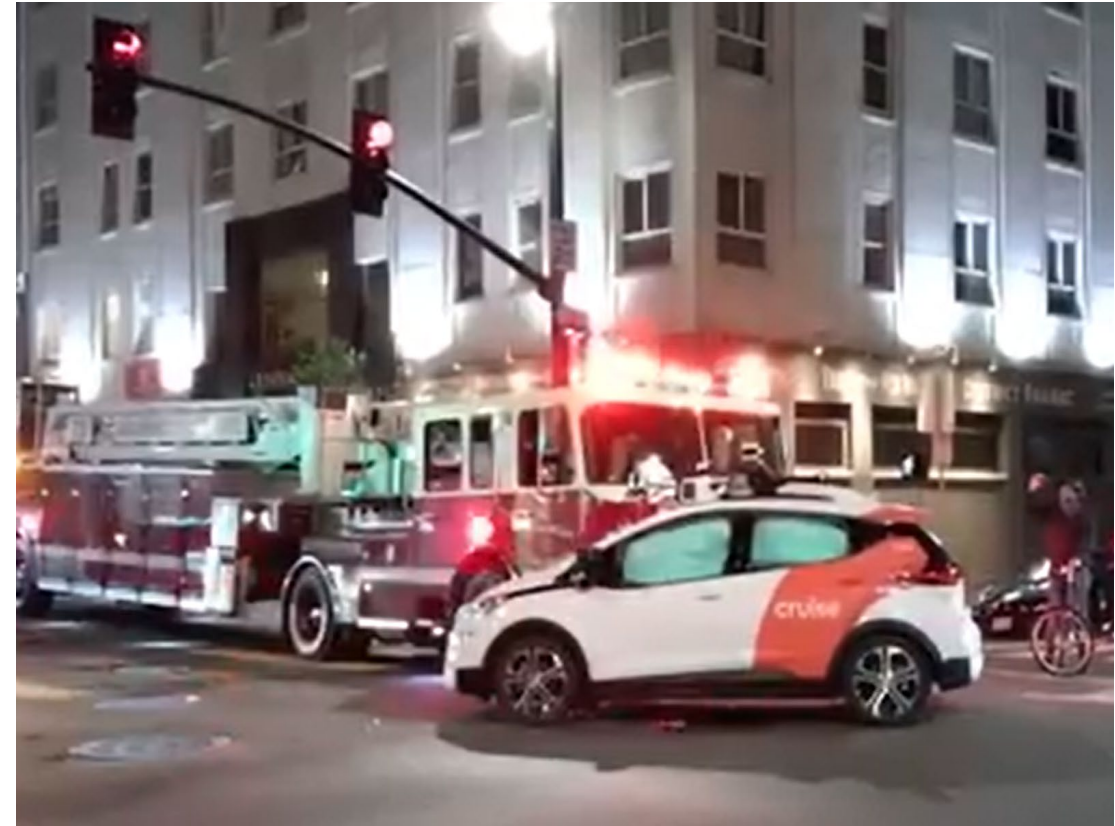
- Avoid active emergency scenes
- Avoid interference around SFFD Stations
- Keep greater distance from SFFD personnel & equipment
- Move away from active emergency scenes faster
- Enable SFFD personnel to move vehicles
- Improve response to human traffic control & immediate on-site communication



8/10/2023 (24th Street @Valencia)

Work on Solutions: Results?

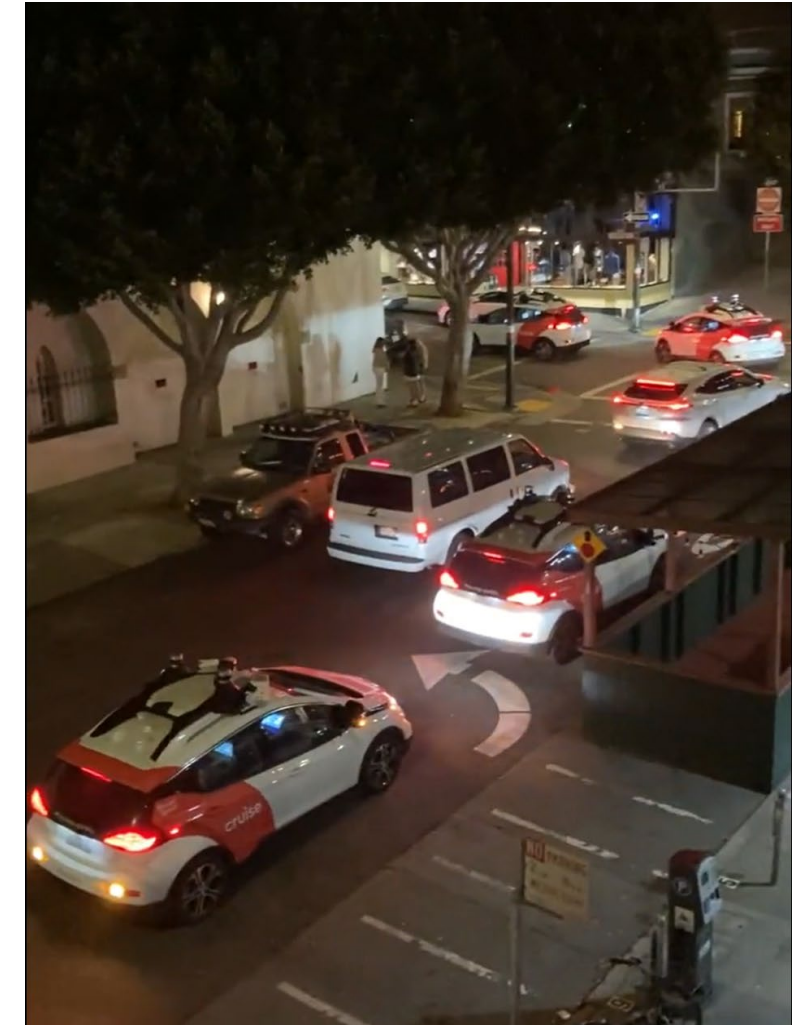
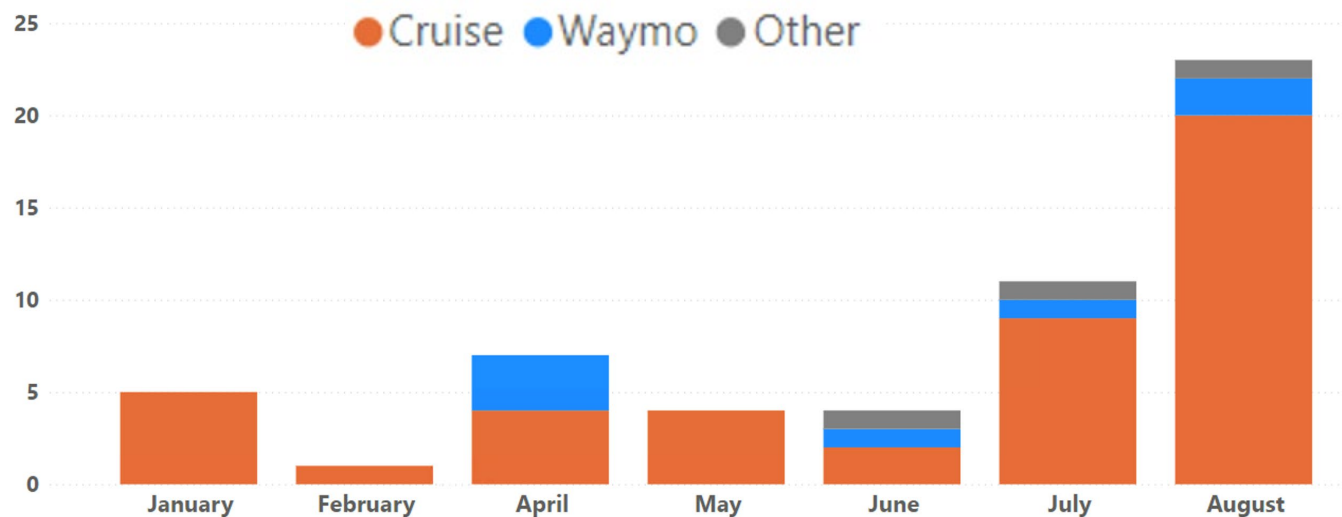
- Department of Emergency Management now notifies AV companies electronically of location & stay away distance for active firefighting scenes
- Cruise & Waymo report making software improvements
- *Too early to know whether Cruise & Waymo changes will avoid and/or mitigate interference incidents*



Multi-AV events raise concerns about driverless operations during major events & disasters

- Electricity outages affecting traffic signals
- Cellular outages affecting communications between AVs & their human supporters
- Software failures affecting fleet

Multi-AV Reported Incidents (Jan – August 2023)

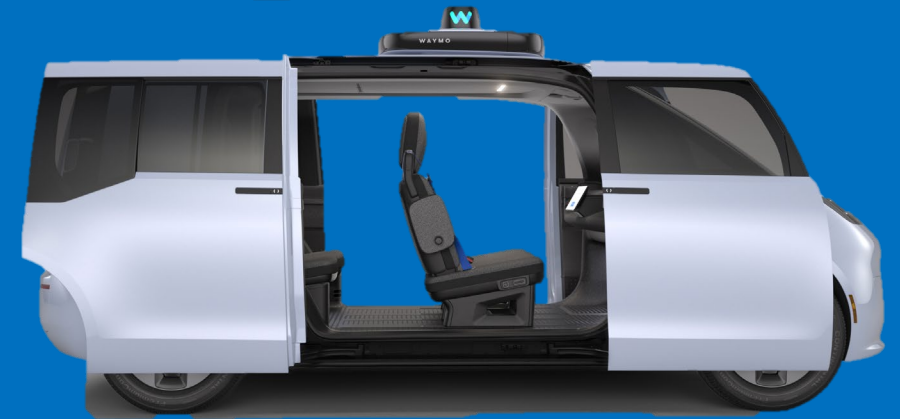


8/11/2023 (Vallejo @Grant @Columbus)

Today



Coming Soon



Advocacy

San Francisco's Experience with Driverless AVs

San Francisco Input to Regulators

Our advocacy has consistently highlighted:

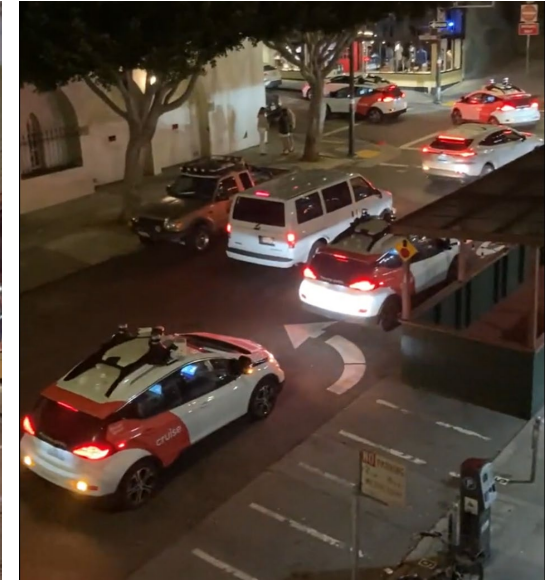
- Regulations should reflect CA transportation goals
- Performance assessment
 - #1 priority is safety
 - Transportation system impacts
 - Access and safety for people with disabilities
- Incremental, performance-based expansion
 - Factors: drivered/driverless, areas of the city, times of day, size of fleet
 - Expand only if performance benchmarks met
 - Data reporting - expanded, timely, aligned, transparent

Chronology of Filings

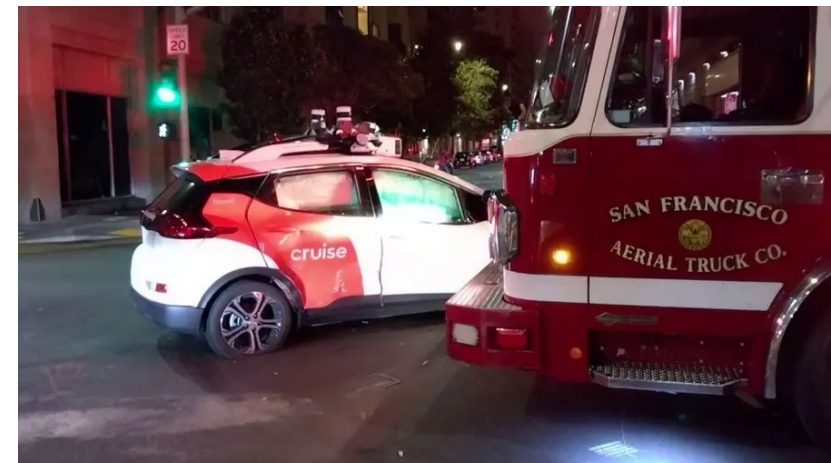
- 2018: 2 filings to CPUC on Regulation of AV Pilot Testing
- 2020: 6 filings to CPUC on Regulation of Commercial AV Passenger Services
- 2021: Filing to CPUC on Cruise Application for Driverless Deployment Permit
- 2022: MAY Filing to CPUC on Cruise Application Proposed Decision
- 2022: SEP Filing to NHTSA re Cruise Origin
- 2022: DEC Board of Supervisors Resolution Endorsing SEP '22 NHTSA filing
- 2023: JAN DMV workshop comments on new AV regulations
- 2023: JAN filings to CPUC re Confidentiality of AVPS Permit Applications
- 2023: JAN filings protesting Cruise and Waymo Commercial AVPS Applications
- 2023: MAY filings to CPUC on Proposed Decisions approving Cruise and Waymo Commercial AVPS applications
- 2023: JUNE filings to CPUC on New Data Reporting Requirements for Commercial AVPS
- 2023: JUNE workshop presentation on New Data Reporting Requirements for Commercial AVPS
- 2023: AUG Presentation to CPUC on Safety Issues Regarding Driverless AV Interactions with First Responders
- 2023: AUG City Attorney Motions to Stay Resolutions Approving Cruise and Waymo Commercial AVPS applications
- 2023: SEP Update to NHTSA re Cruise Origin
- 2023: SEP City Attorney Applications to Rehear Cruise and Waymo Commercial AVPS applications

Recent Developments

- On August 10, the CPUC awarded permits to Cruise and Waymo for unrestricted driverless commercial operations in SF
 - SF Motion to Stay (Aug 16), Application for Rehearing (Sept 10)
 - DMV and Cruise agree to reduce Cruise's operating fleet in half following mid-Aug incidents
 - NHTSA and CA DMV both investigating Cruise
- Inquiries from legislators
 - Letter from Speaker Emerita Pelosi and Rep. Kevin Mullin to NHTSA
 - Letter from CA C&C Chair Boerner and 5 Assemblymembers to CA DMV and CPUC
 - Assemblymember Ting engagement with CA DMV in coordination with SF agencies



Multi-AV outage in North Beach



Crash with firetruck enroute

Opportunities Ahead

- Upcoming rulemaking opportunities
 - NHTSA AV STEP (ADS-equipped Vehicle Safety, Transparency and Evaluation Program)
 - DMV Update of CA AV regulations (2 preliminary workshops held in 2023)
 - CPUC Data Reporting (1 preliminary workshop)
- Engagement with CA DMV and CA Legislature
 - Potential legislative updates led by CA DMV
 - SF reaching out to brief Senate and Assembly Committees with jurisdiction over AVs



Next Steps

- Continued San Francisco advocacy priorities:
 - Beyond **self-certification**, how to assess providers' capabilities
 - Ability to issue **moving violations** and related penalties
 - Data reporting requirements (expansion, timeliness, transparency, consistency)
 - Monitoring and evaluation frameworks based on **performance standards**
 - **Incrementalism** (pace and pathways for expansion)
 - Timeline for incorporating **wheelchair accessible** AVs and other **disability community needs**
 - **Local role** in permit approvals, expansion, and operations management
 - Local impact and **cost recovery**
- Further technical and policy studies to support San Francisco input
- Strengthen collaborations with:
 - Community of practitioners: industry, researchers, academics
 - Disability leaders, equity and sustainability advocates, NGOs
 - Other cities in California and beyond

Treasure Island AV Shuttle Pilot

- Piloting key use-cases for SF mobility needs
 - First / last mile access to transit
 - Local access in low density areas
 - Wheelchair accessible service
- Incremental, performance-based features
 - 2 shuttles in low density area
 - Rich data reporting and associated monitoring and evaluation framework



A wide-angle photograph of a busy city street in San Francisco. The street features a dedicated tram lane with metal tracks in the center. Pedestrians are walking across the street, and a cyclist is riding through the tram lane. Several cars are visible, including a red Toyota SUV and a black sedan. The background shows tall buildings and a clear sky. A large green text box is overlaid on the center of the image.

San Francisco stands ready to partner in the development of a more mature regulatory framework, based on our unique experience and expertise in local AV operations

Thank you.

Jean Paul Velez

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