NHTSA

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

Traffic Jam Assist Test Methodology

Erin Fogle

Transportation Research Center, Inc.

Garrick Forkenbrock

National Highway Traffic Safety Administration

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AGENDA

1. Research Objective
2. Test Methods
3. Observations and Results
4. Concluding Remarks

Research Objective

The tests described in today's presentation:

- Were assembled for research purposes
- Provide a way to objectively define, document, and disseminate how TJA tests may be performed on the test track
- Help assess the state-of-technology
- Will be useful for evaluating vehicles with higher levels of automation in the future

Traffic Jam Assist (TJA)

- Automatically and simultaneously controls:
  - A vehicle's lateral position within the travel lane
  - The longitudinal headway to another vehicle ahead
- Operates at low speeds

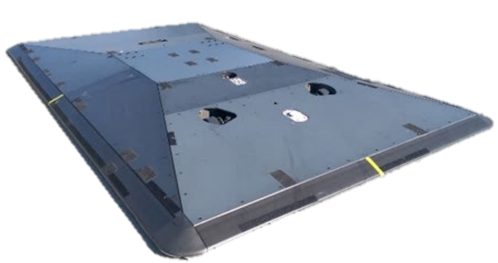
Test Vehicles

Subject Vehicle (SV)

- 2018 Subaru Levorg

Principal Other Vehicle (POV)

- Guided Soft Target (GST)
  - Low Profile Robotic Vehicle (LPRV)
  - Global Vehicle Target (GVT) Revision F



Secondary Other Vehicles (SOV)

- 2017 BMW 540i
- 2017 Volvo S90

Test Conditions

- Three test scenarios
  - Lead Vehicle Decelerates, Accelerates, and Decelerates (LVDAD)
  - Suddenly Revealed Stopped Vehicle (SRSV)
  - Lead Vehicle Lane Change with Braking (LVLCB)
- Headways settings (ACC): Near and Far
- Test speeds: 10, 15, 20, and 25 mph
- POV decelerations: 0.3 and 0.6 g

} where applicable

- 1 trial of each test combination
- 28 tests total

Lead Vehicle Decelerates, Accelerates, then Decelerates (LVDAD)

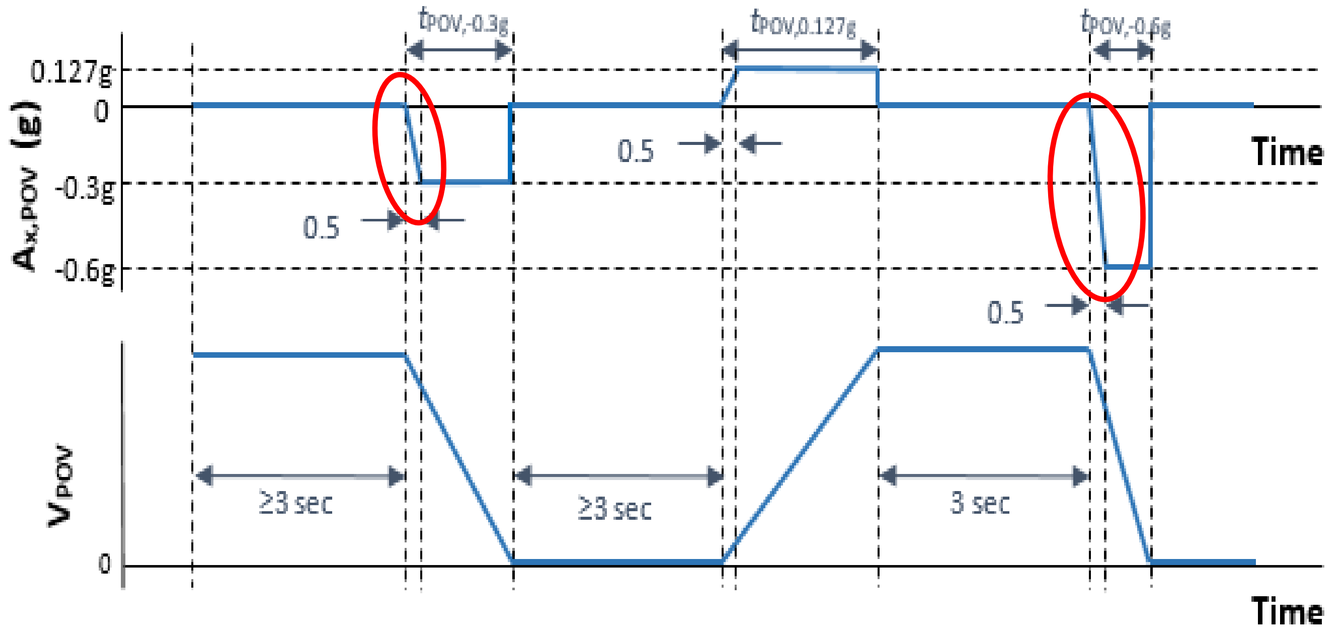
Evaluates the system's ability to detect and respond to a POV that moderately brakes to a stop, pauses, accelerates back to its initial speed, then brakes aggressively to a stop ahead of the SV.

LVDAD Example

Validity Criteria – POV Brake Application

- POV deceleration +/- 0.05 g must be realized within 0.5 s of braking onset
- 64% of the tests satisfied this check

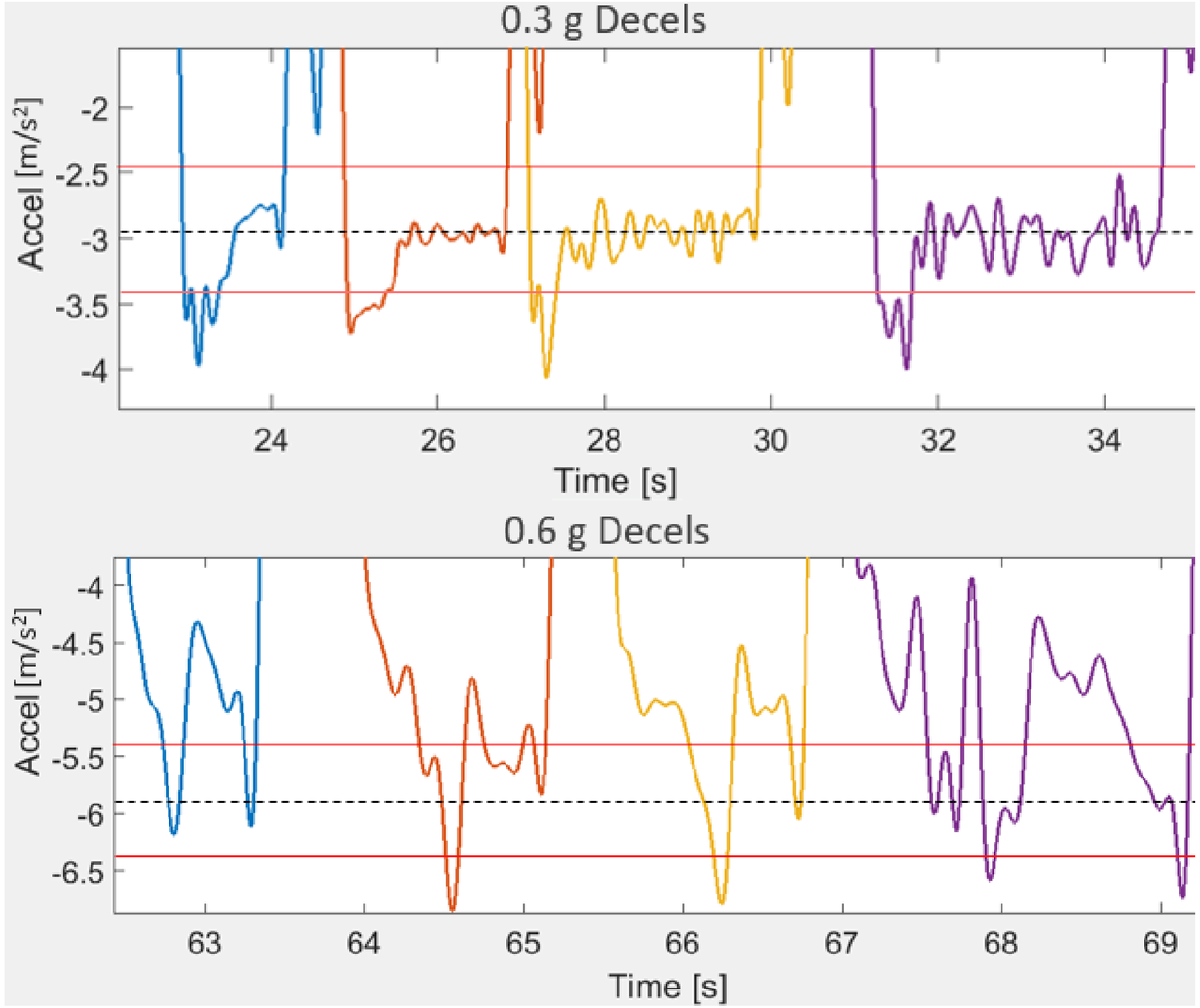
Test Speed	0.3g Target	0.6g Target
10	0.35	0.63
15	0.28 - 0.36	0.40 - 0.57
20	0.34 - 0.35	0.40 – 0.59
25	0.30 - 0.35	0.43 - 0.52



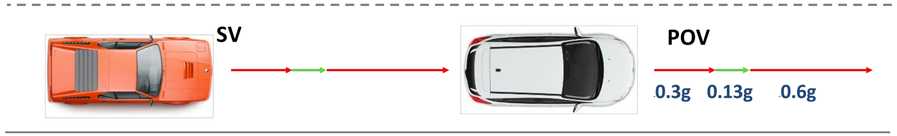
Validity Criteria – Average POV Braking

- Average POV deceleration +/- 0.05 g must be realized over a specific interval
- 75% of the tests satisfied this check

Test Speed	0.3g Target	0.6g Target
10	0.27	0.46
15	0.29 - 0.31	0.53 - 0.58
20	0.29 - 0.31	0.55 - 0.57
25	0.29 - 0.32	0.48 - 0.64



SV LVDAD Responses

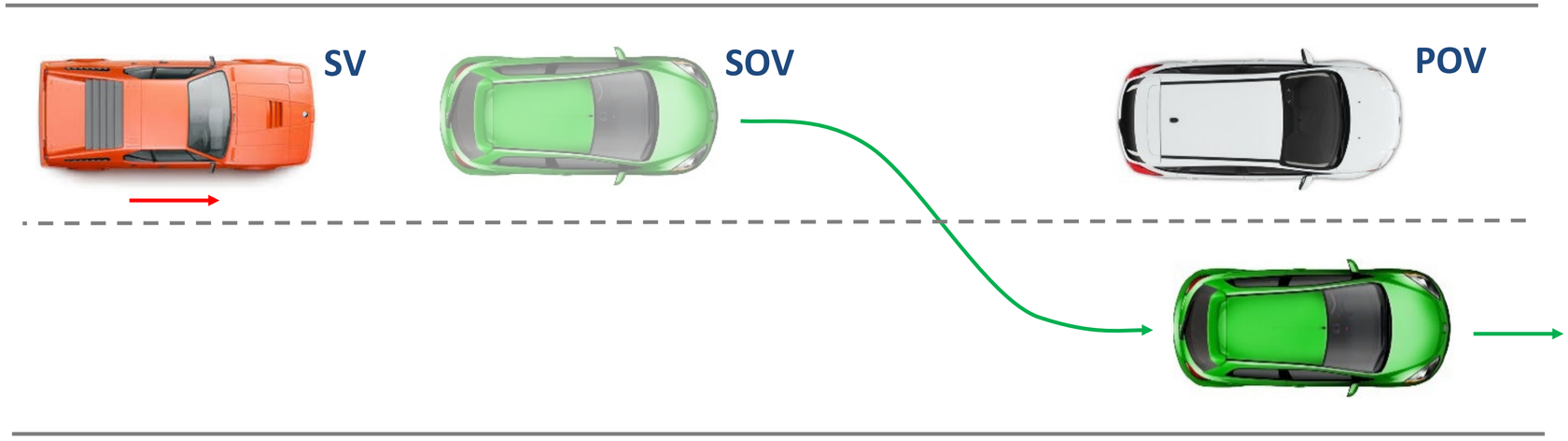


Following Distance		Far		Near	
POV Deceleration		0.3g	0.6g	0.3g	0.6g
10 mph	Min. Range to Target (ft)	11.1	10.6*	6.5	5.4*
15 mph	Min. Range to Target (ft)	11.0	9.6*	6.7	3.0*
20 mph	Min. Range to Target (ft)	11.8	11.3*	6.8	1.4*
25 mph	Min. Range to Target (ft)	11.5	10.9*	6.3	0*
	Impact Speed (mph)	-	-	-	9.8
	Relative Impact Speed (mph)	-	-	-	9.7

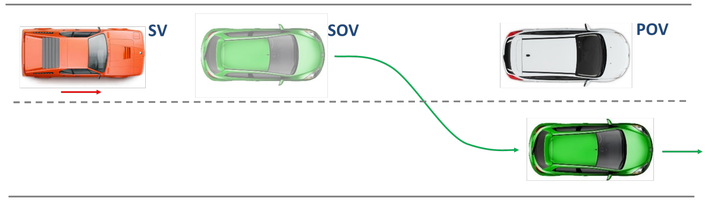
*Test did not meet one or more validity criteria

Suddenly Revealed Stopped Vehicle (SRSV)

Evaluates the system's ability to detect and respond to a stationary POV that is suddenly revealed after an SOV steers around it.



SRSV Example

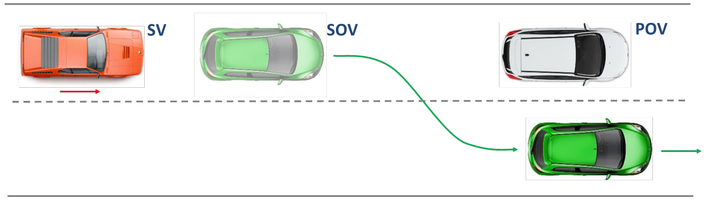


Validity Criteria – POV Reveal Headway

- Yaw rate was used to identify the onset of lane change
- Desired reveal headway is between 39 and 41 ft

Following Distance		Far	Near
10 mph	Reveal Headway (ft)	35.0	35.3
15 mph	Reveal Headway (ft)	39.1	39.0
20 mph	Reveal Headway (ft)	38.2	38.2
25 mph	Reveal Headway (ft)	37.3	37.5

SV SRSV Responses

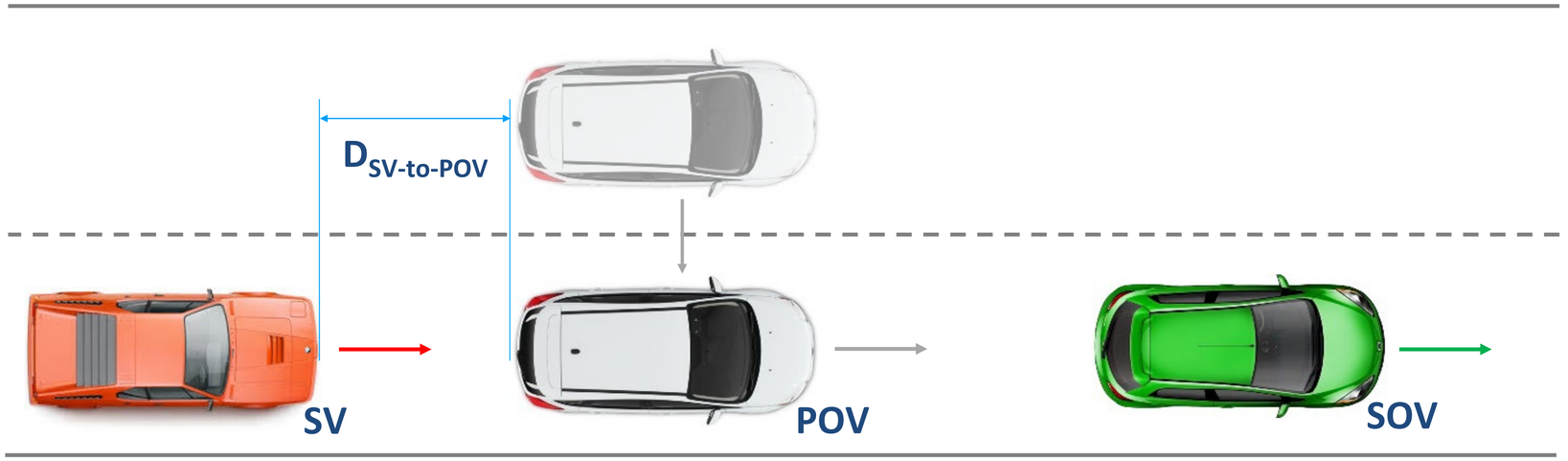


Following Distance		Far	Near
10 mph	Min. Range to Target (ft)	12.7*	6.5*
15 mph	Min. Range to Target (ft)	11.6	3.7*
20 mph	Min. Range to Target (ft)	9.2*	0*
	Impact Speed (mph)	-	16.8
25 mph	Min. Range to Target (ft)	3.9*	0*
	Impact Speed (mph)	-	24.2

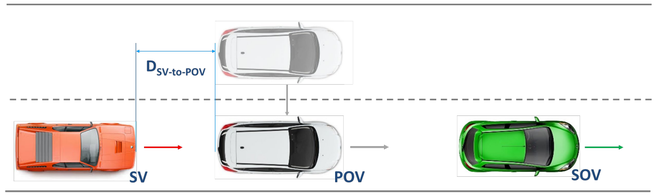
*Test did not meet one or more validity criteria

Lead Vehicle Lane Change with Braking (LVLCB)

Evaluates the system's ability to detect and respond to a moving POV that brakes during and/or after performing a lane change into a space between the SV and SOV.

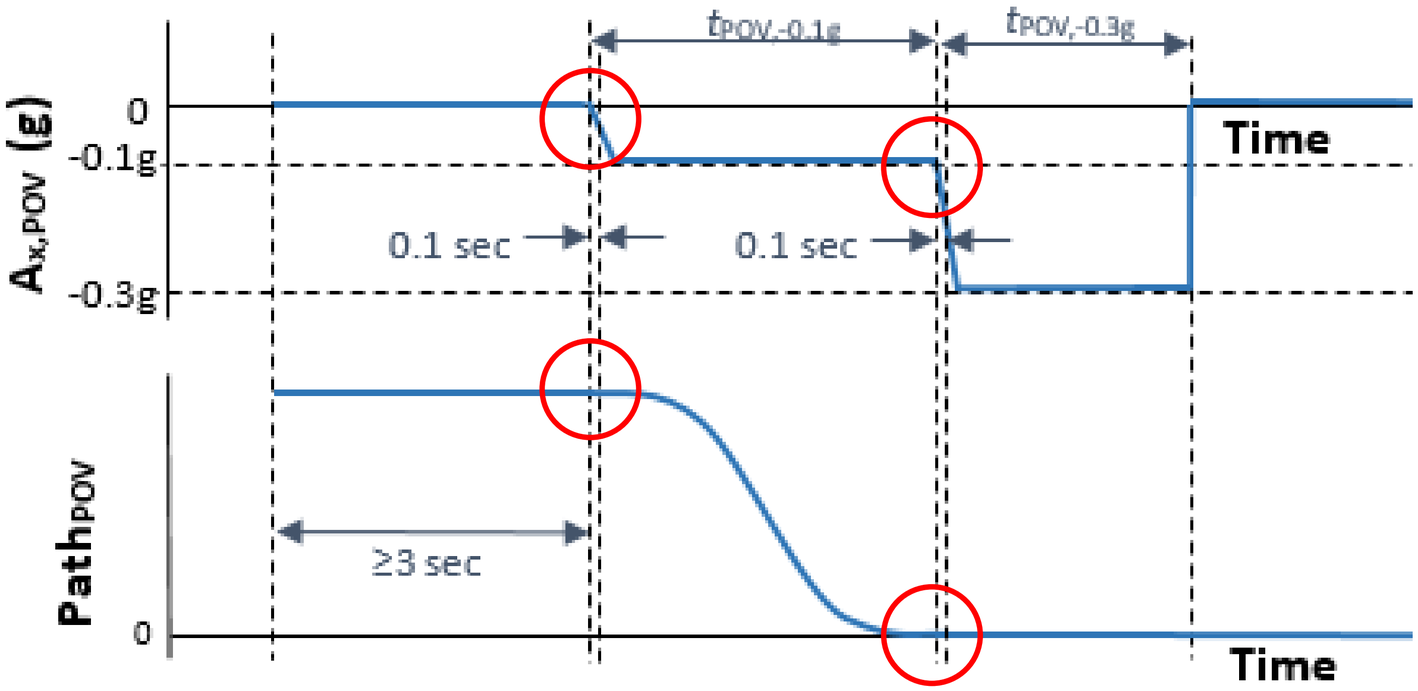


LVLCB Example

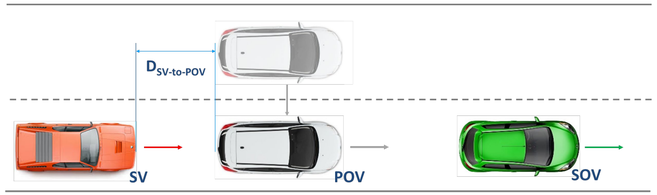


Validity Criteria – POV Deceleration Onset

- POV deceleration must begin within 0.1 s after a lane change event
- 25% of the tests satisfied this check
- Overall ranges:
  - LC onset: -0.29 to 0.01 s
  - LC complete: -1.11 to 0.01 s



SV LVLCB Responses



Post LC Deceleration		0.3g		0.6g	
In-Turn Deceleration		0g	0.1g	0g	0.1g
15 mph	Min. Range to Target (ft)	9.6*		2.6*	
20 mph	Min. Range to Target (ft)	3.4*	0*	0.2*	0*
	Impact Speed (mph)	-	20.0	-	15.5
	Relative Impact Speed (mph)	-	10.1	-	5.9
25 mph	Min. Range to Target (ft)	5.0*	0.9*	0*	0*
	Impact Speed (mph)	-	-	18.0	16.5
	Relative Impact Speed (mph)	-	-	17.2	3.7

*Test did not meet one or more validity criteria

Concluding Remarks

- The TJA test scenarios defined in the April 2018 draft research test procedure were generally performable, however some adjustments were required
- “Lessons learned” will be applied to the test procedure to improve performability
  - Example: Lowering maximum POV braking from 0.6g to 0.5g is expected to improve within-stop consistency and reduce the equipment wear
- Release of the TJA test report and draft research TP is expected later this year

Additional Information

- The draft research TJA test procedure will be available from the National Transportation Library (NTL)
  - Link: https://ntl.bts.gov/
- Contacts:
  - Erin Fogle: Erin.Fogle.ctr@dot.gov
  - Garrick Forkenbrock: Garrick.Forkenbrock@dot.gov

Questions?

Thank you!