NATIONAL ACADEMIES
Sciences
Engineering
Medicine

TRB TRANSPORTATION RESEARCH BOARD

TRB Webinar: Enabling Automated Truck Inspection for Safety

November 9, 2022

1:00 – 2:30 PM

NOVEMBER 2022 UPDATE

Learning Objectives

- Understand the current commercial motor vehicle safety environment and how it is changing
- Identify the role of national and local policy officials in the development of technological solutions to the problem
- Understand how private industry in partnership with law enforcement is leveraging technology to provide a potential solution

PDH Certification Information

1.5 Professional Development Hours (PDH) – see follow-up email

You must attend the entire webinar.

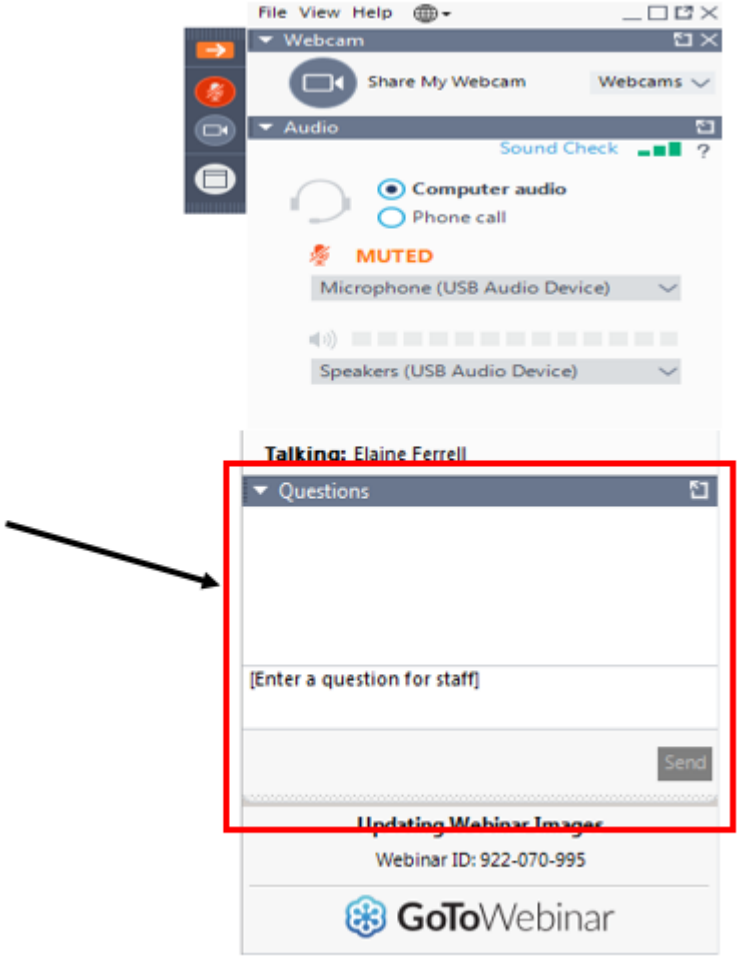
Questions? Contact Beth Ewoldsen at Bewoldsen@nas.edu

The Transportation Research Board has met the standards and requirements of the Registered Continuing Education Providers Program. Credit earned on completion of this program will be reported to RCEP. A certificate of completion will be issued to participants that have registered and attended the entire session. As such, it does not include content that may be deemed or construed to be an approval or endorsement by RCEP.

REGISTERED CONTINUING EDUCATION PROGRAM

Questions and Answers

- Please type your questions into your webinar control panel
- We will read your questions out loud, and answer as many as time allows



Today's presenters

Mark Savage
mark.savage@drivewyze.com
Drivewyze, Inc.

Lt. Nick Doko
ndoko@chp.ca.gov
California Highway Patrol

Collin Mooney
collin.mooney@cvsa.org
Commercial Vehicle Safety Alliance

Sara Steele
sara.steele@drivewyze.com
Drivewyze, Inc.

Enabling Automated Truck Inspection for Safety

NATIONAL ACADEMIES Sciences Engineering Medicine

Nick Doko

Acting Commander
California Highway Patrol
Commercial Vehicle Section

Commercial Motor Vehicle Crash Data Has Been Trending in the Wrong Direction Since 2010…

…So Let's Do *Fewer* Roadside Inspections?

- The Primary Goals of the California Highway Patrol are to Protect Life and Property, Enhance Public Trust Through Superior Service, Invest in The Development of Departmental Employees, and Anticipate Law Enforcement Trends
- Equally important is the goal that everyone goes home safe
- Autonomous Vehicles are coming…..are here
- The role of the commercial licensed driver in a traditional inspection
- Challenges of inspecting vehicles that have automated driving systems
- Enter the CVSA Automated Vehicle working group

Background - Automated CMV Working Group

- Enforcement and Industry Modernization Committee appointed an Automated Vehicle Working Group to consider alternatives to North American Standard Level I inspections.
- The Working Group and the Committee explored options and published recommendations.
- At the September 2022 CVSA Annual Conference, the recommendations were voted upon and adopted by the committee.

Background - Automated CMV Working Group

- ADS operated vehicles present logistical challenges with today's roadside enforcement inspection process
- Roadside inspections/weigh stations are unique operating environments for ADS operated vehicles
- Federal Motor Vehicle Safety Standards, National Highway Safety Administration standards, and Federal Motor Carrier Safety Administration regultory standards for ADS driving performance are needed

Background - Automated CMV Working Group

There are proven CMV inspection approaches that can be applied to ADS/AV operations:

- CVSA Level VI Inspections (Transuranics – Radioactive) program (zero defects upon departure)

- Motorcoach enforcement (preferably origin/destination inspections but varying levels of enroute screening occur – from electronic screening to visual pass-by inspection to full inspection if an imminent safety hazard is observed.)

Automated CMV Working Group Report

“Option 7—This option would apply to SAE Levels 4 to 5 CMVs. It would limit roadside inspection of these vehicles to situations where an imminent hazard is observed or during a post-crash investigation, and instead focus on an origin/destination (terminal) inspection model. The vehicle would be required to communicate to enforcement while in-motion that it had passed the origin/destination inspection, that its ADS systems (as a whole) were functioning, and that it is operating within its ODD.”

NATIONAL ACADEMIES Sciences Engineering Medicine

https://www.cvsa.org/inspections/resources/

TMC Study Group Position Paper: 2021-1

- Task force convened at TMC in Feb. 2020.
- Position paper published in Oct. 2021 supporting CVSA proposal.
- Position paper also serves to document industry role for interactions with roadside safety enforcement personnel.
- Raises awareness among motor carriers.

TMC Study Group Position Paper: 2021-1

Issued: October 2021

(S.18) Automated & Electric Vehicles Study Group

Recommendations Regarding Inspection and Enforcement for Automated Commercial Vehicles

Developed by the Technology & Maintenance Council's (TMC) (S.18) Automated Commercial Vehicle Inspection and Enforcement Task Force

ABSTRACT

ATA's Technology & Maintenance Council (TMC) recommends that the industry consider the Commercial Vehicle Safety Alliance (CVSA) Option 7 framework as a model for enhanced pre-trip inspections model for Automated Commercial Vehicles (ACMVs). TMC believes this approach, which seeks to eliminate en-route stops for roadside inspections, represents the most logical framework for inspections of ACMVs that have no human occupants onboard. TMC also suggests all stakeholders continue discussions in order to address inhibiting factors identified in this paper so as to operationalize this model, and to delineate the technical and maintenance requirements for its various elements.

INTRODUCTION

This position paper was developed by TMC's S.18 Automated and Electric Vehicle Study Group through its Automated Commercial Vehicle Inspection and Enforcement Task Force, whose scope and objective is to develop information reports, position papers and recommended practices to assist commercial

suppliers, maintenance and telematics service providers — with the ACMV developer community along with governmental stakeholders including the Federal Motor Carrier Safety Administration (FMCSA) and law enforcement, as represented by CVSA. All of these groups must work to reach consensus on inspections and enforcement processes for ACMVs, but

https://tmc.trucking.org/blog/recommendations-regarding-inspection-and-enforcement-automated-commercial-vehicles-tmc/

CVSA Standing Policy Guide

"…CVSA supports limiting enforcement stops for roadside inspections of ADS equipped CMVs, except in the case of imminent hazard, provided that those vehicles:

- are subject to an enhanced inspection process, developed by CVSA, and conducted by a CVSA trained individual, and

- are subject to/compatible with remotely communicating completion of an enhanced inspection and the status of ADS components."

Collin Mooney,
Executive Director, CVSA

CVSA Enhanced Commercial Motor Vehicle Inspection Standard (for motor carrier operations)

NATIONAL ACADEMIES Sciences Engineering Medicine

CVSA Enhanced CMV Inspection Standard

No-defect, point-of-origin inspection program for ADS-equipped commercial motor vehicles.

Includes:

- an enhanced inspection standard and procedure for motor carriers operating ADS vehicles
- a 40-hour CVSA training course and exam for motor carrier personnel who will be conducting the inspections

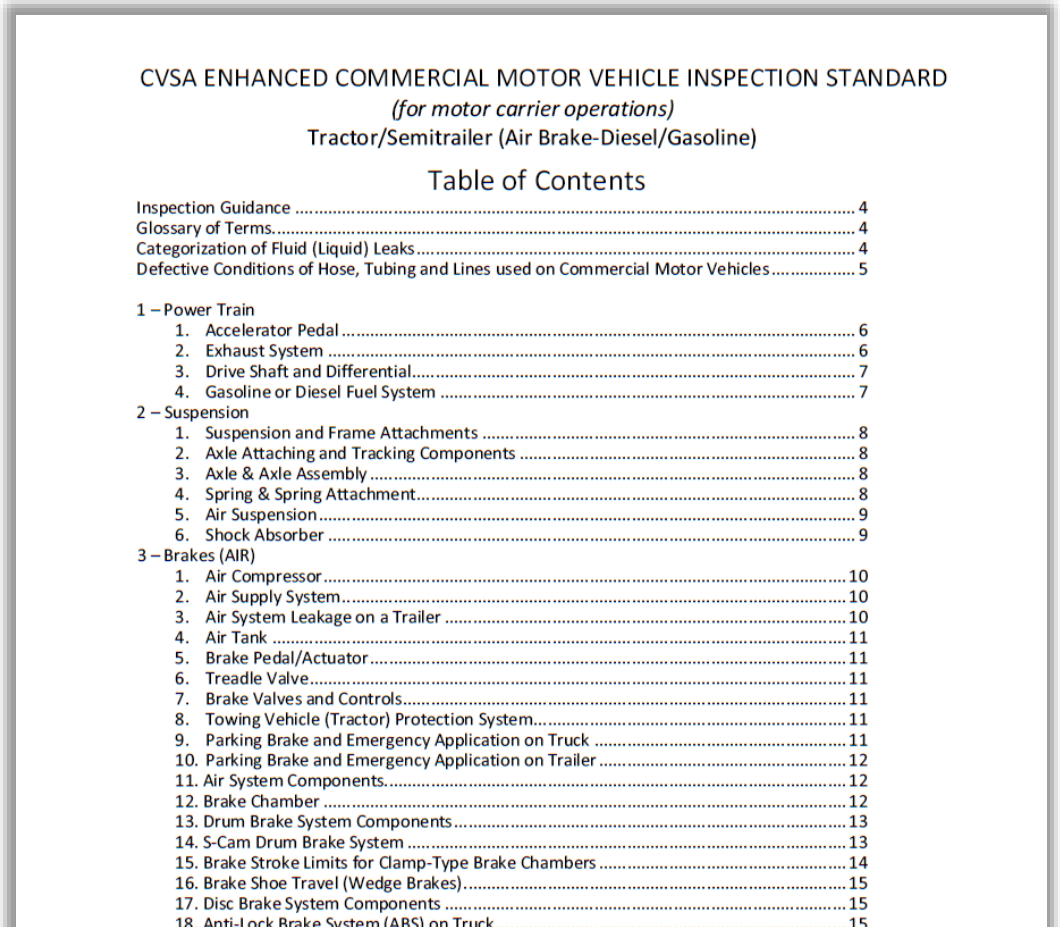
CVSA Enhanced CMV Inspection Materials

- CVSA Enhanced CMV Inspection Standard and Procedure
- CVSA Enhanced CMV Inspection Course Participant Manual
- CVSA Enhanced CMV Inspection Course Training (10 sections)

CVSA Enhanced CMV Inspection Materials

Inspection Standard

- 10 sections of vehicle requirements
- 45 pages



CVSA ENHANCED COMMERCIAL MOTOR VEHICLE INSPECTION STANDARD

(for motor carrier operations)

Tractor/Semitrailer (Air Brake-Diesel/Gasoline)

Table of Contents

NATIONAL ACADEMIES Sciences Engineering Medicine

CVSA Enhanced CMV Inspection Materials

Inspection Standard

CVSA ENHANCED COMMERCIAL MOTOR VEHICLE INSPECTION STANDARD

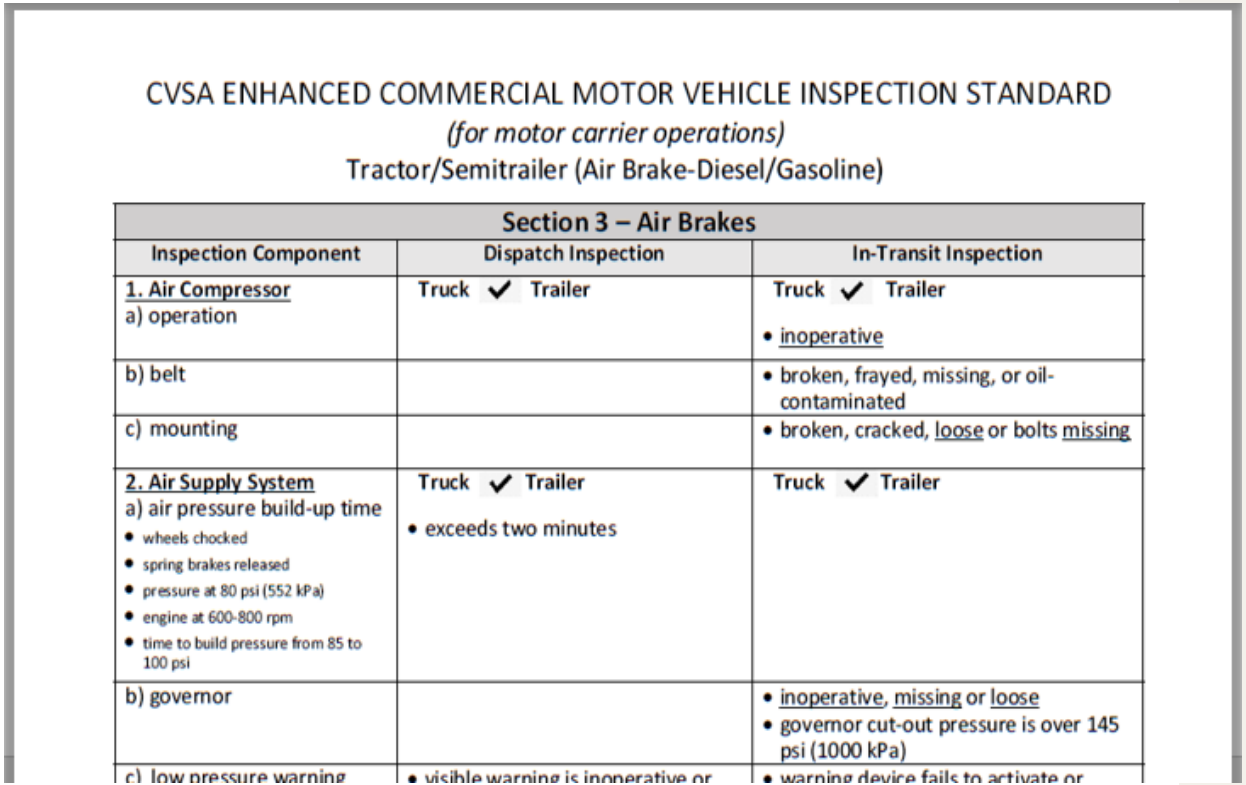
(for motor carrier operations)

Tractor/Semitrailer (Air Brake-Diesel/Gasoline)

Section 3 – Air Brakes		
Inspection Component	**Dispatch Inspection**	**In-Transit Inspection**
4. Air Tank a) air tank condition	**Truck** ✓ **Trailer** ✓ • welding other than original factory weld on air tank	**Truck** ✓ **Trailer** ✓ • corroded or damaged to the extent that structural integrity is compromised, leaking or loose
b) air tank bracket and/or strap		• broken, cracked or missing
c) air tank drain valve		• inoperative, leaking, loose or missing
5. Brake Pedal/Actuator a) pedal	**Truck** ✓ **Trailer** • broken, cracked, loose, missing or abnormally worn	**Truck** ✓ **Trailer**
b) mount	• deteriorated or weakened by corrosion, or insecure	
c) anti-slip feature	• ineffective, loose or missing	
6. Treadle Valve a) operation	**Truck** ✓ **Trailer** • inoperative	**Truck** ✓ **Trailer** • pivot or plunger is binding or seized (fails to fully release brakes)

CVSA Enhanced CMV Inspection Materials

Inspection Standard



CVSA ENHANCED COMMERCIAL MOTOR VEHICLE INSPECTION STANDARD

(for motor carrier operations)

Tractor/Semitrailer (Air Brake-Diesel/Gasoline)

Section 3 – Air Brakes		
Inspection Component	**Dispatch Inspection**	**In-Transit Inspection**
1. Air Compressor a) operation	Truck ✓ Trailer	Truck ✓ Trailer • inoperative
b) belt		• broken, frayed, missing, or oil-contaminated
c) mounting		• broken, cracked, loose or bolts missing
2. Air Supply System a) air pressure build-up time • wheels chocked • spring brakes released • pressure at 80 psi (552 kPa) • engine at 600-800 rpm • time to build pressure from 85 to 100 psi	Truck ✓ Trailer • exceeds two minutes	Truck ✓ Trailer
b) governor		• inoperative, missing or loose • governor cut-out pressure is over 145 psi (1000 kPa)
c) low pressure warning	• visible warning is inoperative or	• warning device fails to activate or

NATIONAL ACADEMIES Sciences Engineering Medicine

CVSA Enhanced CMV Inspection Materials

Inspection Standard

		psi (1000 kPa)
c) low pressure warning	• visible warning is inoperative or missing • visible warning is not clearly identified, lamp lens is missing • audible warning, if equipped, is inoperative or missing	• warning device fails to activate or operate continuously when air pressure is lowered below 60 psi (414 kPa)
d) air pressure gauge	• gauge is inoperative or has inaccurate reading	
e) pressure drop/reserve		• pressure drops more than 20 psi (138 kPa) when a full service brake application is made
f) air leakage		• detectable leak at any location
g) air loss rate test • spring brakes off/service brakes on • pressure at 80 psi (552 kPa) • ensure all air systems are charged (e.g., air suspension)	• pressure drops more than 1 psi (7 kPa) per minute (tractor only) – engine off	• air pressure cannot be maintained with the engine running and service brakes applied/spring brakes released
3. Air System Leakage on a Trailer a) air leakage	**Truck** **Trailer** ✓	**Truck** **Trailer** ✓ • detectable leak at any location
b) air loss rate test • spring brakes off/service brakes on • pressure at 80 psi (552 kPa) • ensure all air systems are charged (e.g., air suspension)	• trailer is attached to a towing vehicle and total leakage exceeds 4 psi (28 kPa) in one minute – engine off	

CVSA Enhanced CMV Inspection Materials

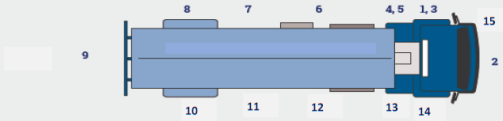
Participant Manual

- 165 pages
- 40-hour course – classroom and practical
- 90% required to pass

CVSA Enhanced CMV Inspection Materials

Inspection Procedure

Enhanced CMV Inspection *(for motor carrier operations)*



1 Prepare the Vehicle for Inspection
- Check the periodic inspection(s) for validity.
- Check the license plate, DOT number and carrier name.
- Place the chock blocks, put the vehicle transmission in neutral, release all the brakes, ensure the air pressure is at maximum, turn engine off and ensure the key is in the "on" position.

2 Inspect Front of Tractor (and the rear for lighting)
- Check headlamps (low and high beam), ID, clearance, turn signals, and any other required lamps for improper color, operation, mounting and visibility.
- Ensure the ABS lamp on the trailer is marked and not activated.
- Inspect the bumper for security.
- Inspect ADS sensors (camera, lidar, radar)

3 Inspect Left Front Side of Tractor
- Inspect the hood and latch.
- Check front wheel, rim, hub and tire.
- Inspect visible portions of the frame.
- Inspection the door for operation.
- Check the side windows and rearview mirror.

4 Inspect Left Saddle Tank Area
- Check fuel tank area.
- Check exhaust system, if applicable.
- Inspect the battery for security and leaks, if visible.
- Inspect visible portions of the frame and mounts.

5 Inspect Trailer Front/Rear of Tractor
- Check air and electrical lines.
- Inspect the cab air suspension, shocks and reefer, if applicable.
- Inspect the cab reflective markings
- Inspect the headache rack or bulkhead of trailer.
- Inspect the fenders for security.

6 Inspect Left Rear Tractor Area
- Check wheels, rims, hubs and tires
- Check the lower, upper and slider components of the fifth wheel assembly.
- Check all required lamps and reflective tape.
- Inspect the rear window, if applicable.
- Check the condition of the mudflaps/fenders.
- Inspect the reefer, if applicable.

7 Inspect Left Side of Trailer
- Inspect the landing gear.
- Check frame and body (upper/lower rails/crossmembers of trailer).
- Check the condition of the aerodynamic device, if applicable.
- Check the reflective tape along the side of the trailer.

8 Inspect Left Rear Trailer Wheels
- Check wheels, rims, hubs and tires.
- Check the frame and visible suspension components.
- Ensure the sliding subframe is secured and the pins, guides and handle are in place.
- Inspect the condition of the mudflaps.

9 Inspect Rear of Trailer
- Inspect the reflective markings.
- Inspect the rear impact guard, if applicable.
- Inspect the aerodynamic device, if applicable.
- Check the condition of the cargo doors and the security of the cargo.
- Check the tail lamps, license plate lamp and lamp on projected load.

10 Inspect Right Rear Trailer Wheels
- Check as in step 8.

11 Inspect Right Side of Trailer
- Check as in step 7.
- Check the spare tire security, if applicable.

12 Inspect Right Rear Tractor Area
- Check as in step 6.

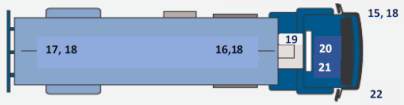
13 Inspect Right Saddle Tank Area
- Check as in step 4.

14 Inspect Right Front Side of Trailer
- Check as in step 3.

15 Inspect Steering Axle (activate hazard lamps)
- Inspect hazard lamps.

Pull the hood of the tractor to get a better view of components.
- Check steering system (power steering fluid), front suspension and front brake components.
- Scribe the brakes, if necessary and determine chamber size.
- Check the front axle, frame and crossmembers.
- Inspect visible inside sidewall tire condition.

www.cvsa.org



16 Inspect Axles 2 and/or 3
- Check driveline/driveshaft.
- Inspect the exhaust system for security and leaks.
- Check the suspension, brake components and tires on both sides.
- Check the air tanks for security and condition.
- Scribe the brakes, if necessary and determine chamber size.
- Inspect the axles, frame members and crossmembers.
- Check the hazard lights at rear of tractor for operation.

17 Inspect Axles 4 and/or 5
- Check the suspension, brake components and tires on both sides.
- Scribe the brakes, if necessary and determine chamber size.
- Inspect the axles, frame members and crossmembers.
- Check the hazards lights at rear of trailer

18 Check Brake Adjustment
- Ensure air pressure is 90-100 psi (620-690 kPa).
- Apply the service brakes fully (person or device).
- Measure and record the pushrod travel (if applicable) and ensure brake lining to drum contact.
- Listen for air leaks.
- Inspect the brake lights on the tractor and trailer.

19 Inspect the Tractor Protection System

Note: This procedure tests both the tractor protection system and the emergency brakes.
- Ensure the emergency brakes are still released and then disconnect both brake lines from the trailer. Ensure the air stops coming from the supply line before 20 psi.
- Inspect for bleedback from the trailer.
- Ensure the emergency brakes applied on the trailer.
- Ensure the air stops leaking from the supply line.
- Apply a full brake application.
- Listen for air leaks.
- Reconnect the lines.

20 In-Cab Inspection
- Inspect the driver's seat and seatbelt.
- Inspect the interior and exterior sun visor condition.
- Check windshield for damage, wipers and washers for proper operation.

20 In-Cab Inspection (continued)
- Check the function of the horn.
- Record the odometer and check the speedometer.
- Inspect the function of the ABS malfunction lamp(s).
- Check for a fault on the ESC or RSS for trailer.
- Inspect the ADS fault system.
- Start the tractor and push in the dash valves (parking brakes released).

While engine is at idle (600 – 800 rpms):
- Ensure that the low air pressure warning device activates by pumping the foot valve to exhaust air.
- Build air up to 80 psi. and check the function of the air gauge(s).
- Conduct the air pressure buildup test (builds from 85 – 100 psi within two minutes).
- Ensure the governor cuts out before 145 psi.
- Ensure the pressure does not drop more than 20 psi. on brake application.
- With air pressure at 80 psi, apply the service brake and conduct the air pressure loss rate test. (combination - loss of more than 4 psi in one minute/tractor only - loss of 1 psi in one minute)
- With the engine running, measure steering wheel lash while wheels are straight.
- Check the telescopic/tilt steering, steering wheel and column.
- Inspect the fire extinguisher and hazard warning devices.
- Check the defroster/heater/brake pedal and accelerator pedal.
- Check the floor and condition of the cab for holes, etc.

21 Check Fifth Wheel/Tractor Parking Brakes

Caution: If conducted improperly, this method of checking for fifth wheel movement can result in serious damage to the vehicle.
- Remove the chock blocks and apply the spring brakes on the trailer.
- Put the tractor in drive/reverse and feel for excessive play in the fifth wheel.
- Apply all the spring brakes on both tractor and trailer and check the brake pushrods for application.

22 Inspect Cargo Securement
- Ensure the cargo is secured, blocked or tied down, as required.

23 Complete the Vehicle Inspection Report
- Complete a trip inspection report.
- Repair any defects that are detected.

NOTE: Fifth wheel movement, ABS malfunction lamp operation on trailer and reverse lamp cannot be adequately inspected in a one-person inspection – it is recommended that if there is another person available to get assistance for these items.

www.cvsa.org

CVSA Enhanced CMV Inspection Materials

Course Slide Deck

CVSA Enhanced Commercial Vehicle Inspection Course

- This course is intended to train individuals employed by a motor carrier to be certified to conduct the CVSA Enhanced Commercial Motor Vehicle Inspection on vehicles prior to dispatch and for inspections in-transit.
  - Final Exam – 90%
  - Practical Inspection – 90%
  - 32 Inspections with a certified inspection coach prior to full certification

0-4-1

What's the solution?

ENHANCED INSPECTION PROCEDURE

Approved by CVSA October 2022

- ☑ Enhanced Trip Inspection Pre-Dispatch
- ☑ Enhanced Trip Inspection In-transit
- ☑ ADS Functioning & Operating within ODD

Vehicle can bypass inspection sites

May 2022 Beta Test

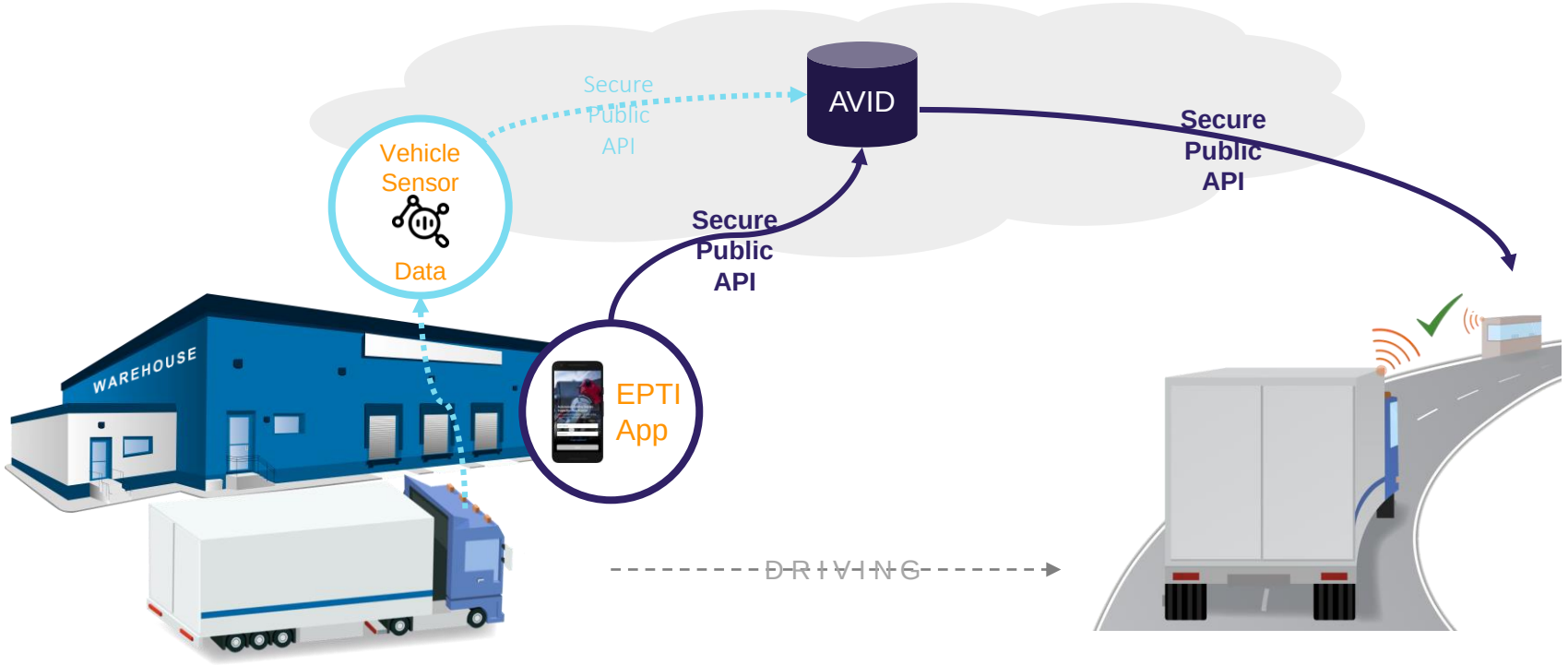
- May 2-6, 2022 – Grapevine, Texas
- 32 attendees – ADS developers, motor carriers, enforcement and CVSA staff
- CVSA staff delivered the course and attendees went through the training
- Revised course based on feedback

Sara Steele,
Product Manager &
Director, Compliance

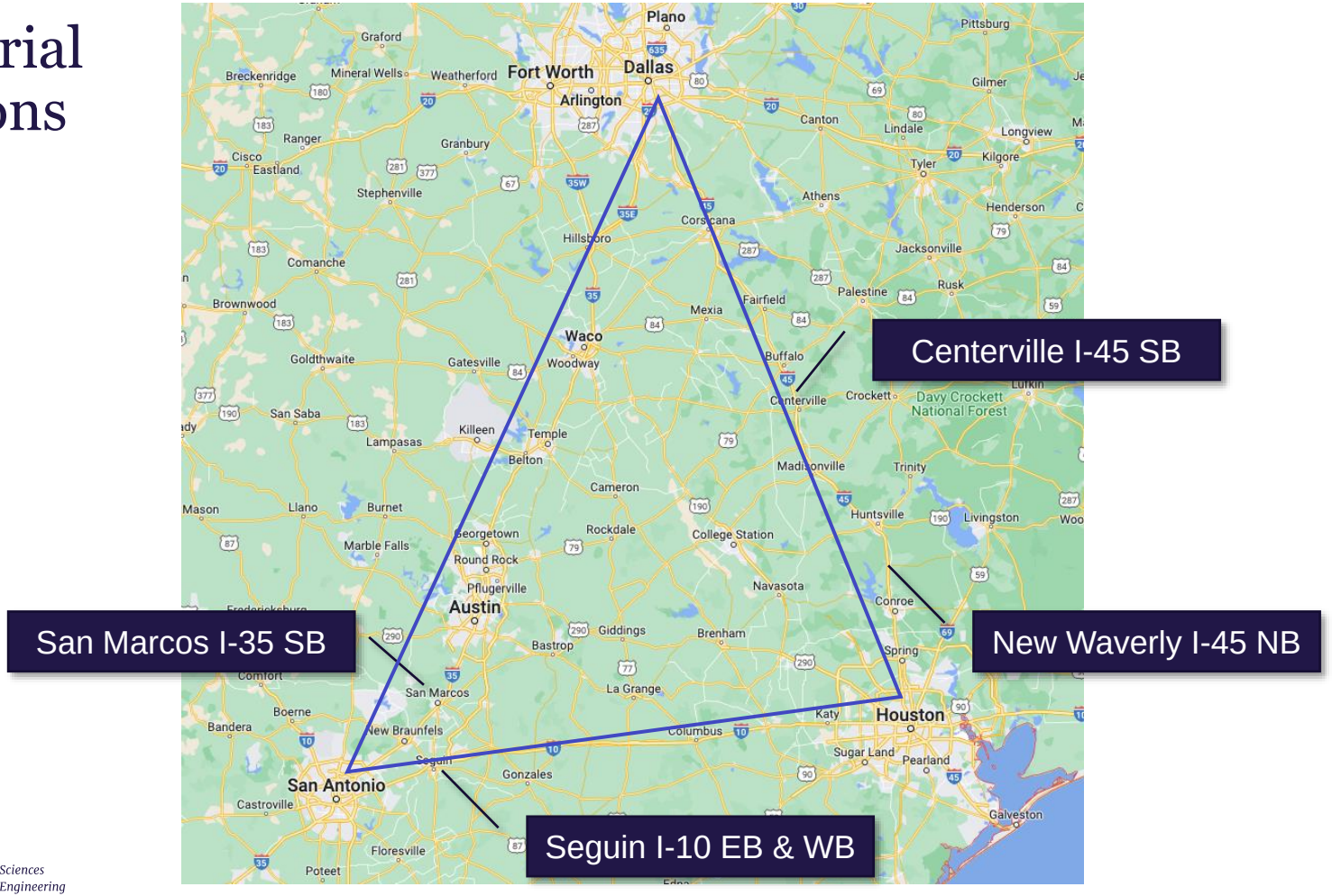
Inspection Procedure Field Trial

NATIONAL ACADEMIES Sciences Engineering Medicine

Data/Workflow



Field Trial Locations



NATIONAL ACADEMIES Sciences Engineering Medicine

Future Inspection Capabilities

Inspection Standard Established

Inspection standard & procedure defined and accepted

Point of Origin & In-Transit Inspections

Inspections being conducted and data transmitted to weigh stations

Real-time Sensor Data

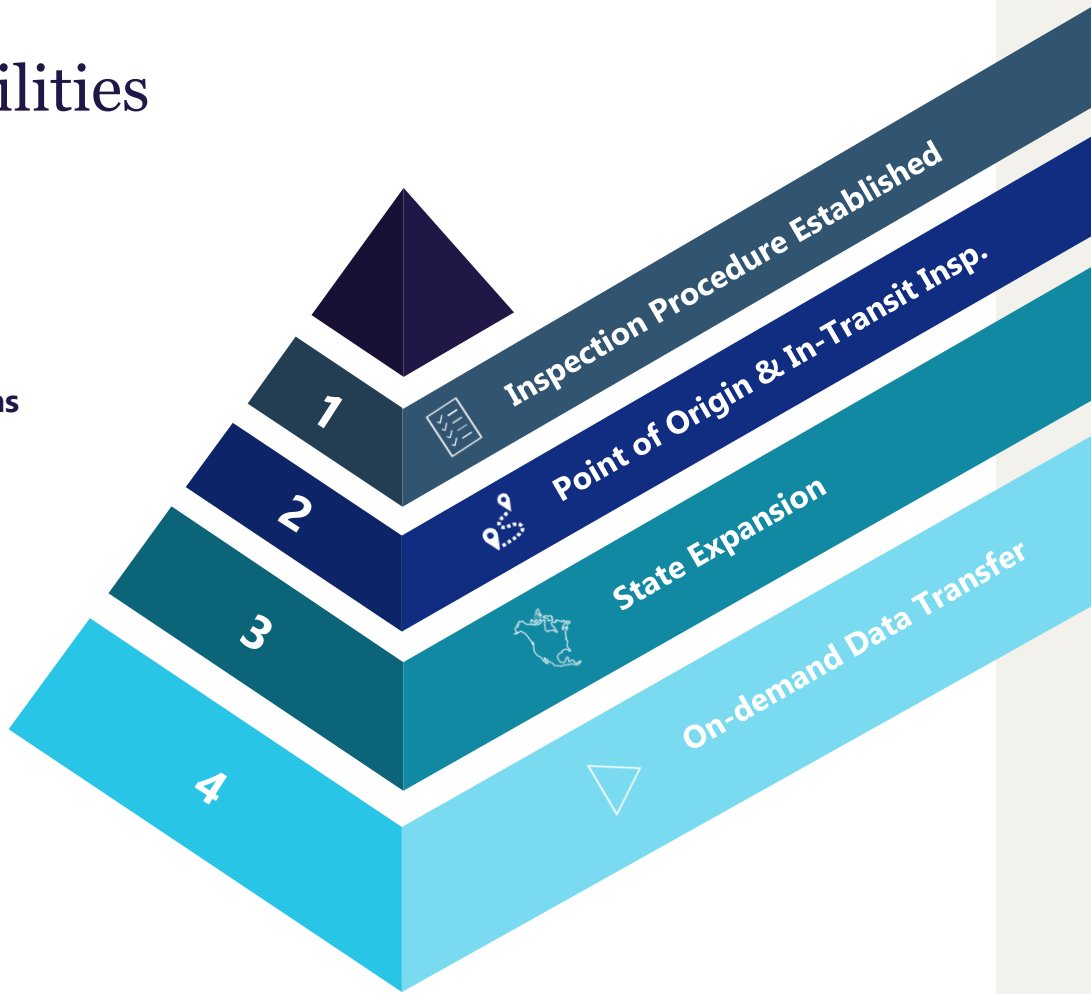
Integrate real-time ADS sensor data and transmit to weigh stations

State Expansion

Expand pilot to additional states

On-demand Data Transfer

Support on-demand data transfer to roadside officials



Thank you!

Today's presenters

Mark Savage
mark.savage@drivewyze.com
Drivewyze, Inc.

Lt. Nick Doko
ndoko@chp.ca.gov
California Highway Patrol

Collin Mooney
collin.mooney@cvsa.org
Commercial Vehicle Safety Alliance

Sara Steele
sara.steele@drivewyze.com
Drivewyze, Inc.

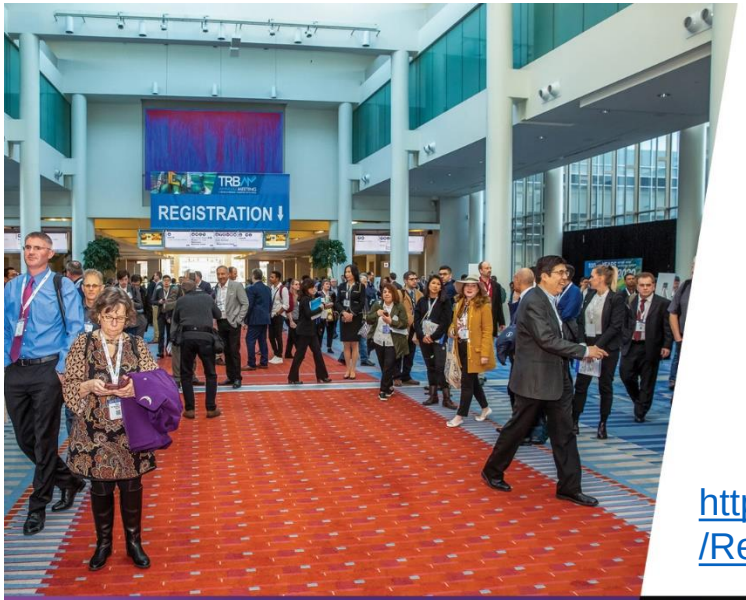
Upcoming events for you

January 8-12, 2023

TRB Annual Meeting

https://www.nationalacademies.org/trb/events

Register for the 2023 TRB Annual Meeting



Register to be part of the **action!**

Scan me

https://www.trb.org/AnnualMeeting/Registration.aspx

Follow the conversation
#TRBAM

NATIONAL ACADEMIES Sciences Engineering Medicine

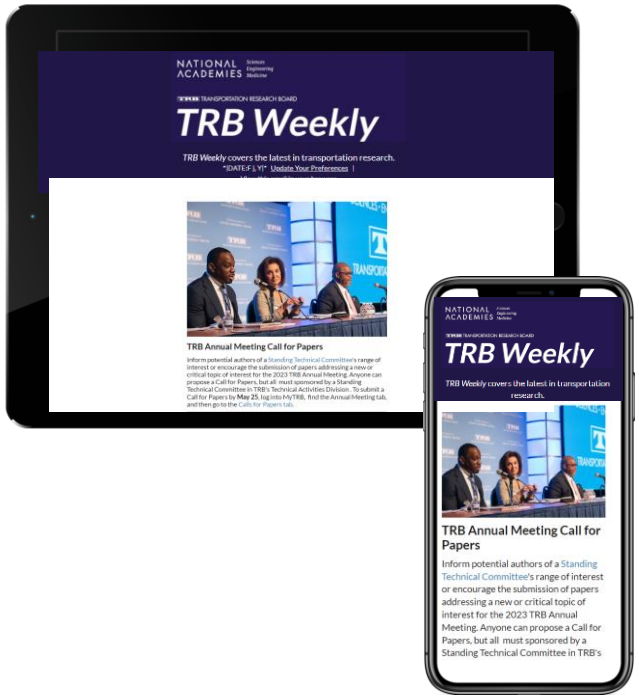
TRB TRANSPORTATION RESEARCH BOARD

Subscribe to *TRB Weekly*

If your agency, university, or organization perform transportation research, you and your colleagues need the *TRB Weekly* newsletter in your inboxes!

Each Tuesday, we announce the latest:

- RFPs
- TRB's many industry-focused webinars and events
- 3-5 new TRB reports each week
- Top research across the industry



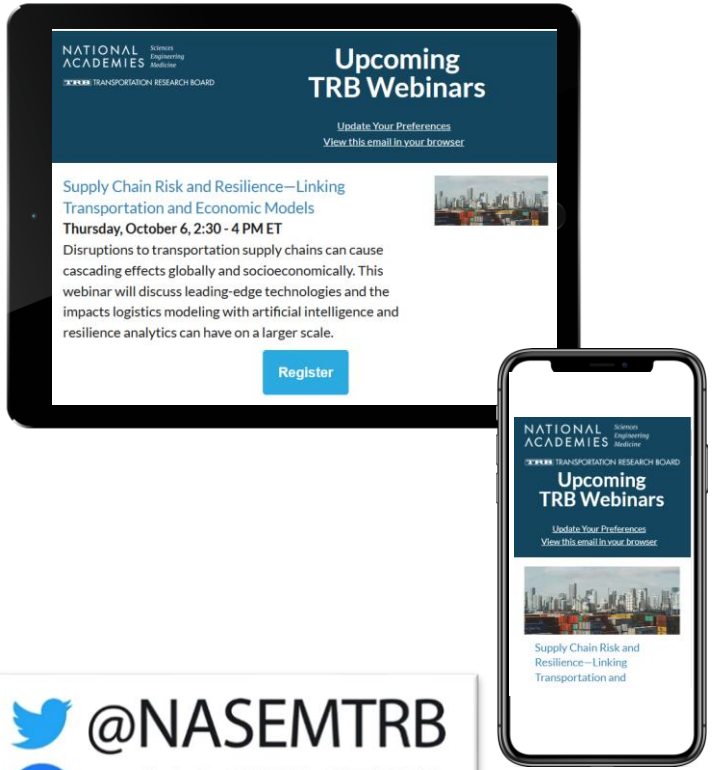
Spread the word and subscribe!
https://bit.ly/ResubscribeTRBWeekly

Discover new TRB Webinars weekly

Set your preferred topics to get the latest listed webinars and those coming up soon every Wednesday, curated especially for you!

https://mailchi.mp/nas.edu/trbwebinars

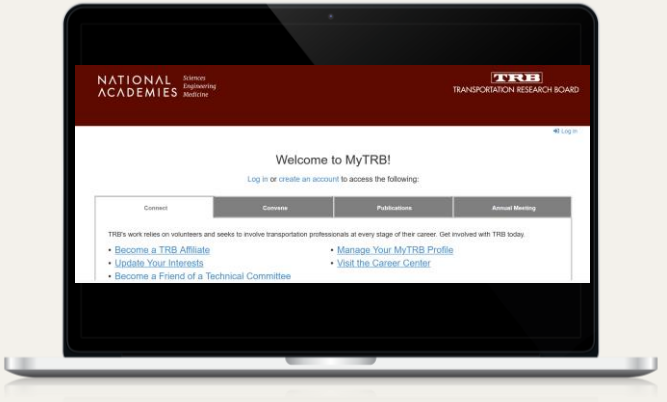
And follow #TRBwebinar on social media



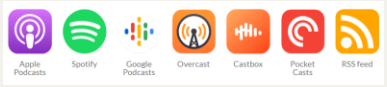
@NASEMTRB
@NASEMTRB
Transportation Research Board

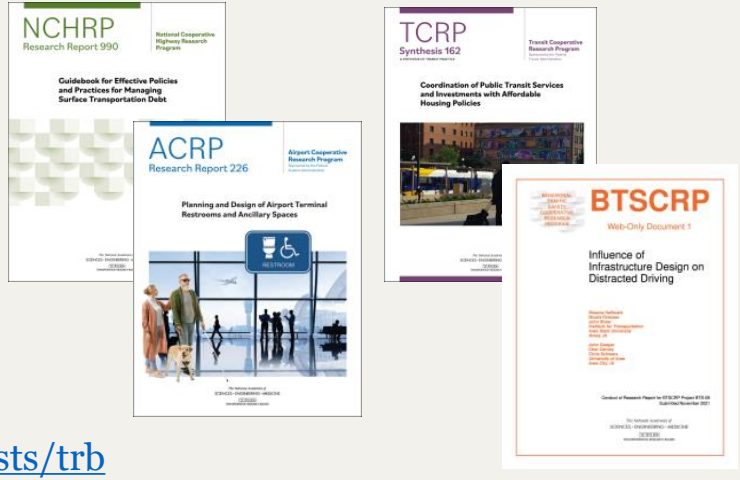
Get involved

https://www.nationalacademies.org/trb/get-involved



- **Become a Friend of a Standing Technical Committee**
  Network and pursue a path to Standing Committee membership
- **Work with a CRP**
- **Listen to our podcast**

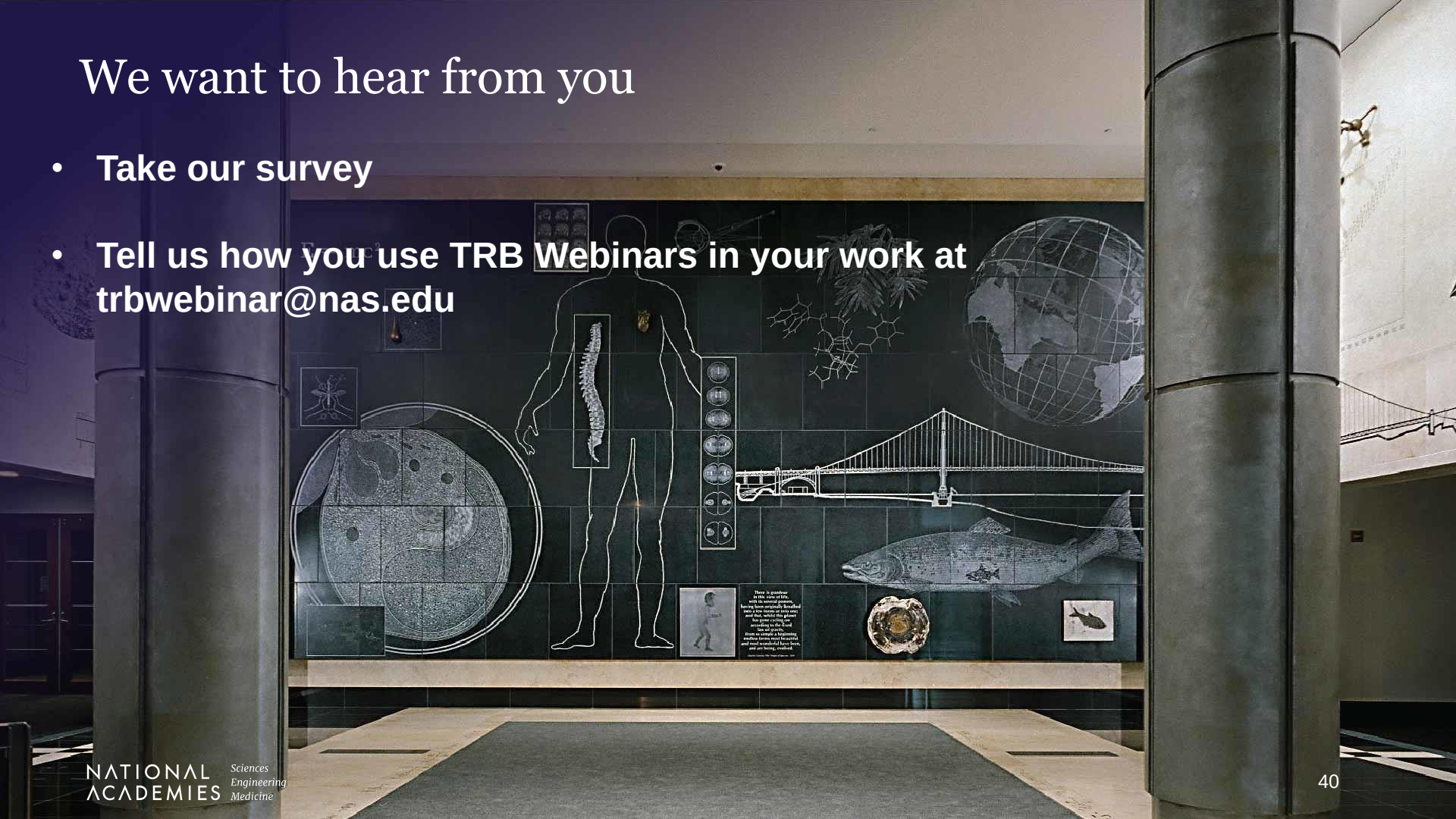




https://www.nationalacademies.org/podcasts/trb

We want to hear from you

- **Take our survey**
- **Tell us how you use TRB Webinars in your work at trbwebinar@nas.edu**



NATIONAL ACADEMIES Sciences Engineering Medicine