



NHTSA

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

Comparison of Seat Belt Elongation Requirements

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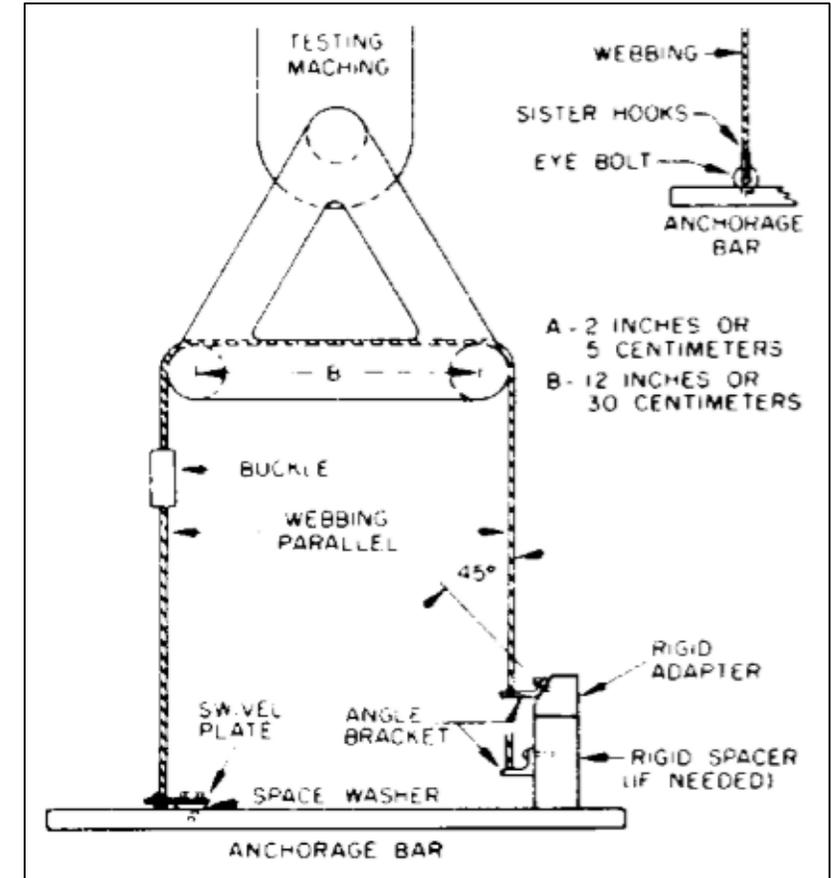
Presentation Outline

- Background
 - Federal Motor Vehicle Safety Standard (FMVSS) No. 209
 - United Nations (UN) Economic Commission for Europe (ECE) Regulation (R) 16
- Research Objectives
- Test Plan
 - Test Matrix
 - FMVSS No. 209 Assembly Tensile Testing
 - UN ECE R16 Dynamic (Sled) Testing
 - Rear Seat Buck Sled Testing
 - FMVSS No. 209 Assembly Tensile Testing at In Use Angles
- Status and Next Steps

Background

FMVSS No. 209

- FMVSS No. 209 “Seat belt assemblies” specifies performance requirements (minimum force and maximum elongation) for seat belt assemblies in a quasi-static tensile test (S5.3).
- However, seat belt assemblies installed in front outboard seating positions of vehicles required to meet S5.1 of FMVSS No. 208 do not have to meet the elongation requirement.

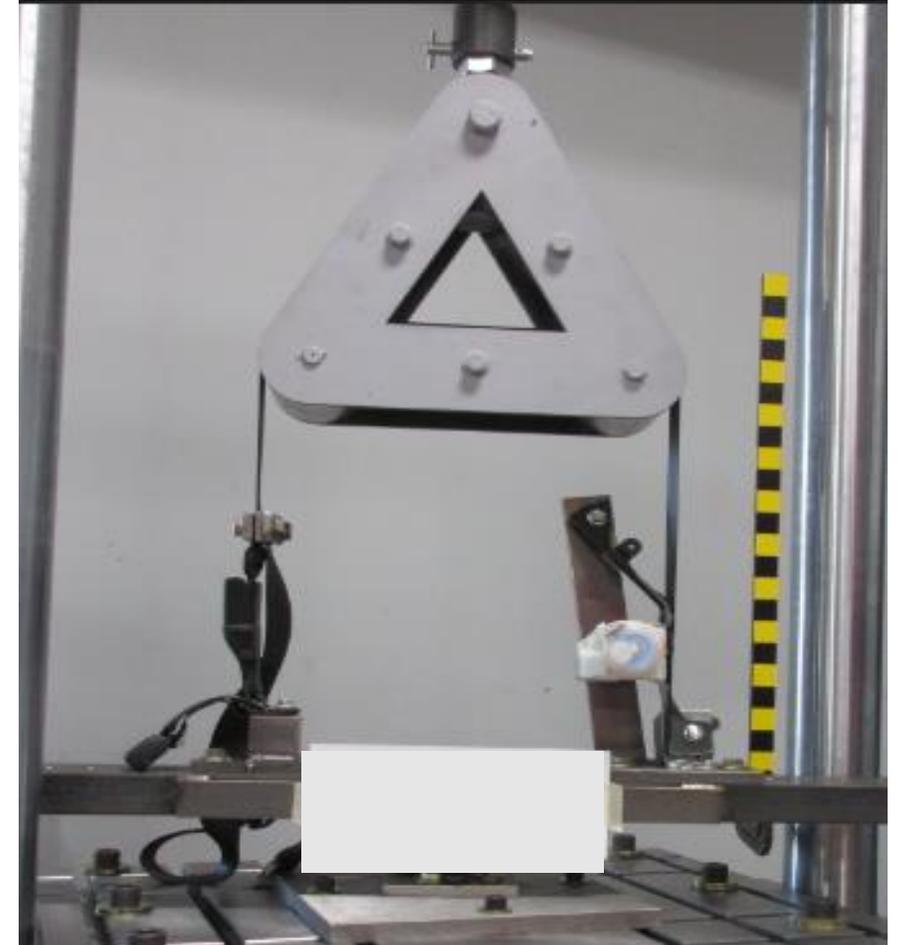


§571.209 Standard No. 209; Seat belt assemblies.

Background

FMVSS No. 209

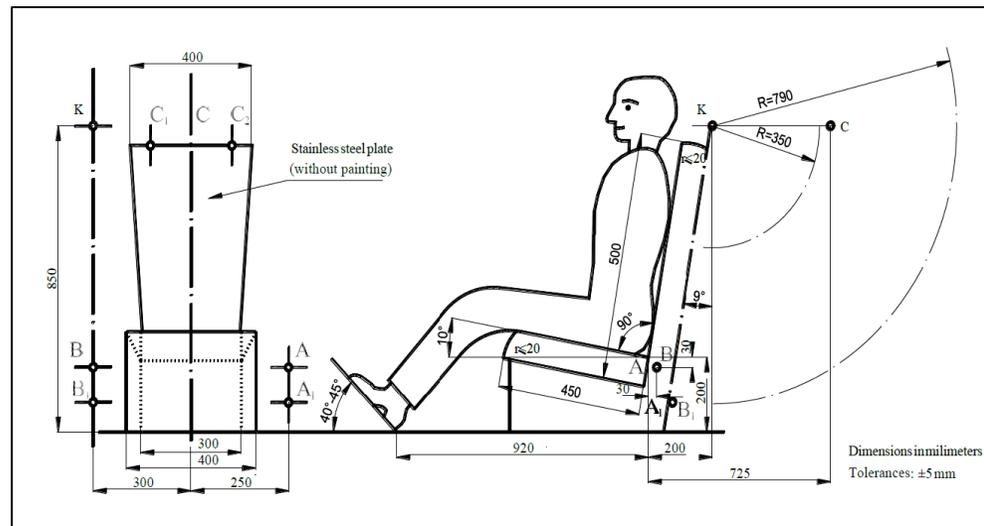
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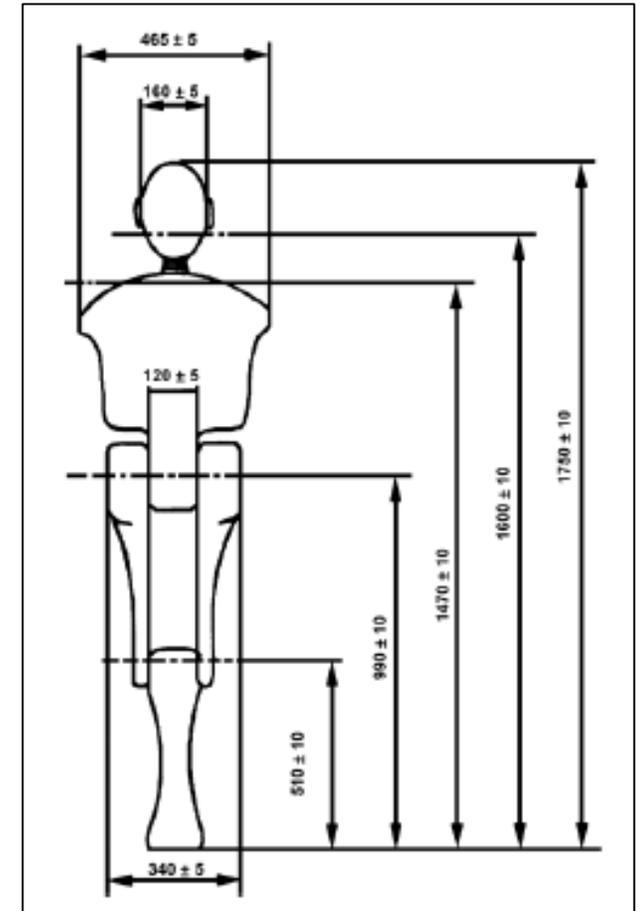
Background

UN ECE R16

- European regulation UN ECE R16 specifies performance requirements (chest and pelvis excursion) for seat belt assemblies in a dynamic (sled) test
 - Utilizes a manikin representing a 50th male made from polyurethane and steel
- In response to ANPRM “Removing regulatory barriers for innovative motor vehicle technologies,” Alliance of Automobile Manufacturers suggested the UN ECE R16 sled test as an alternative to the existing FMVSS No. 209 test elongation requirement.



Safety-Belts and Restraint Systems Regulation No. 16-05

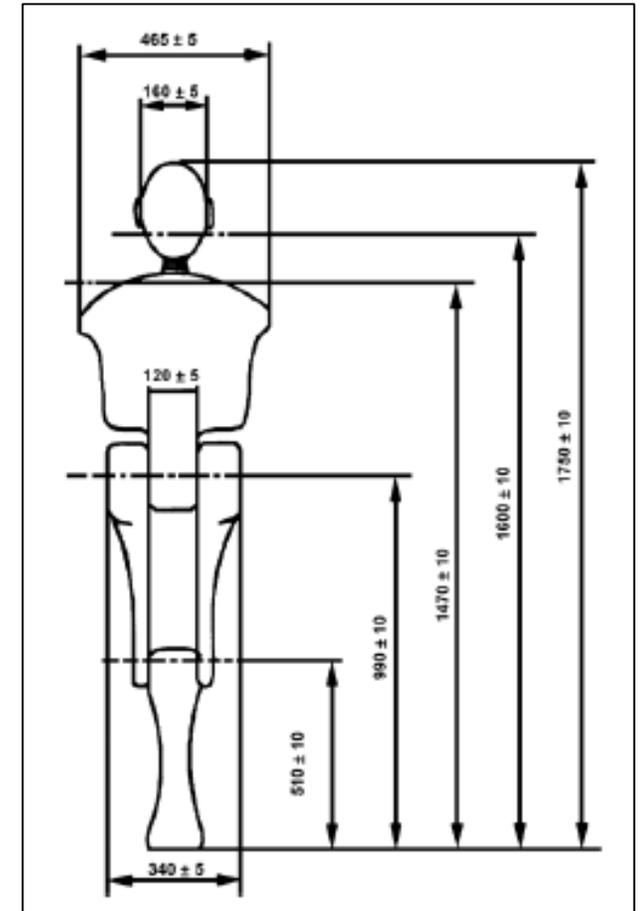


Safety-Belts and Restraint Systems
Regulation No. 16-05

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**Safety-Belts and Restraint Systems
Regulation No. 16-05**

Research Objectives

- To understand if there is a relationship between the quasi-static requirements of US regulation and dynamic requirements in European regulation. Additionally, to gather injury prediction metrics from ATDs.



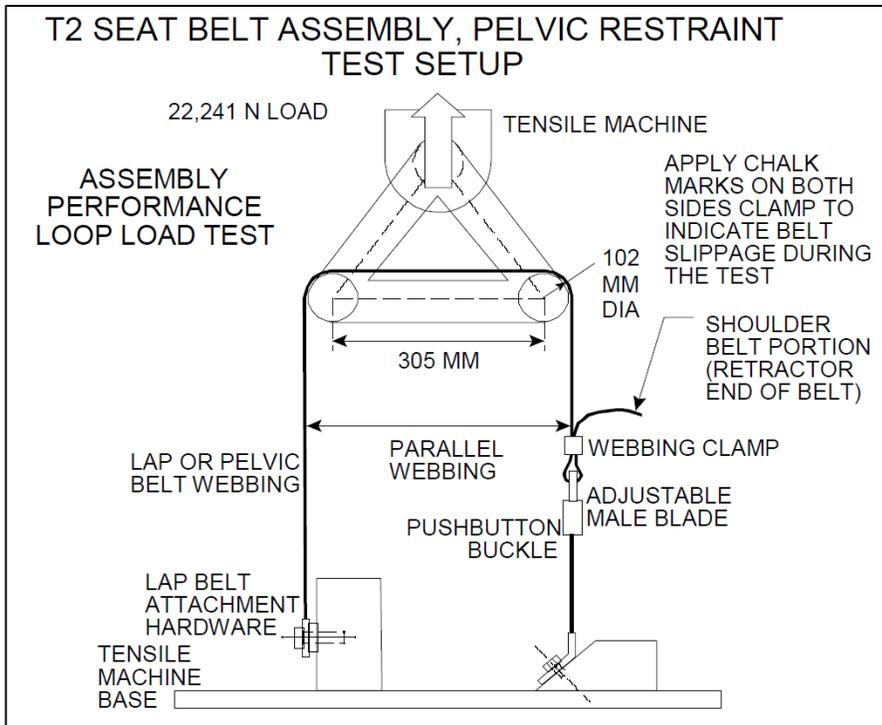
Test Matrix

#	YR/MAKE/MODEL	US/EU	POSITION	TYPE	LOAD LIMITER?
1	2019 Lexus ES	US	LH	Lap	-
				Shoulder	Y
2	2019 Lexus ES	EU	LH	Lap	-
				Shoulder	Y
3	2019 Subaru Impreza WGN	US	RH	Lap	-
				Shoulder	N
4	2019 Subaru Impreza WGN	EU	RH	Lap	-
				Shoulder	Y
5	2019 Chevrolet Suburban	US	RH	Lap	-
				Shoulder	N
6	2019 Chevrolet Suburban	EU	RH	Lap	-
				Shoulder	?
7	2018 Mercedes S-class	US	RH	Lap	-
				Shoulder	Y
8	2018 Toyota Camry	US	LH	Lap	-
				Shoulder	Y
9	2018 Nissan Maxima	US	LH	Lap	-
				Shoulder	N

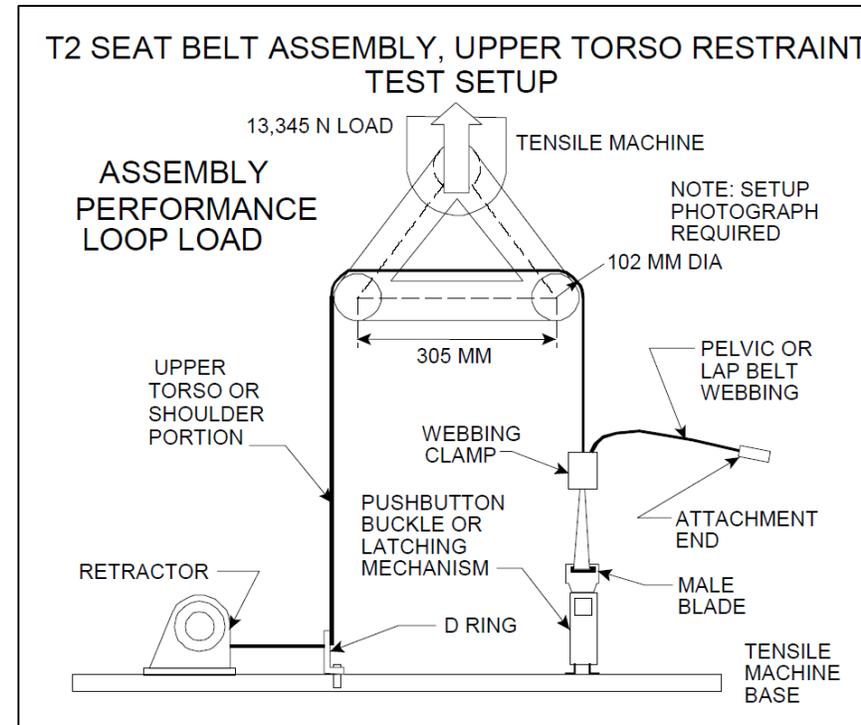
- Rear seat belt assemblies
 - Left hand (LH) and right hand (RH)
- 3 matched pairs of seat belt assemblies for US and EU
- With and without load limiters

FMVSS No. 209 Assembly Tensile Testing

- Test rear seat belt assemblies, both lap and shoulder belt set-ups, per FMVSS No. 209 test procedure (TP-209-08)



TP-209-08 Lap Belt Set-up Example



TP-209-08 Shoulder Belt Set-up Example

UN ECE R16 Dynamic (Sled) Testing

- Conduct sled tests with the ECE R16 test bench with a subset of belts from the test matrix
 - Use ECE R16 manikin, Hybrid III 50th ATD, and THOR 50th ATD
 - Use ECE R16 acceleration sled pulse and speed requirements
- Analyze data for comparison of manikin to ATD excursions and injury measures including:
 - Compare FMVSS No. 209 static requirements (force/elongation) with measured belt loads and excursions in sled tests
 - Compare ECE R16 excursions with injury measures from Hybrid III and THOR 50th ATDs
 - Compare kinematics/excursions of the three ATDs

Rear Seat Buck Sled Testing

- Conduct sled test using a rear seat sled buck (to be determined)
 - Use ECE R16 manikin, Hybrid III 50th ATD, and THOR 50th ATD
 - Plan to use a typical frontal US NCAP sled pulse
- Analyze data for comparisons between test environments including:
 - Compare belt loads and elongation results
 - Compare injury measures from Hybrid III and THOR 50th ATDs
 - Compare kinematics/excursions of the three ATDs

FMVSS No. 209 Assembly Tensile Testing at In Use Angles

- FMVSS No. 209, S5.3(a)(2) states “...attaching bolts or nonthreaded anchorages of a seat belt assembly designed for use in specific models of motor vehicles **shall be installed to produce the maximum angle in use** indicated by the installation instructions, utilizing special fixtures if necessary to simulate installation in the motor vehicle.”
- Conduct tensile tests using vehicle in use angles between webbing and attachment hardware
- Results to be additional comparison between FMVSS No. 209 assembly tensile test, UN ECE R16 sled test, and rear seat buck sled test

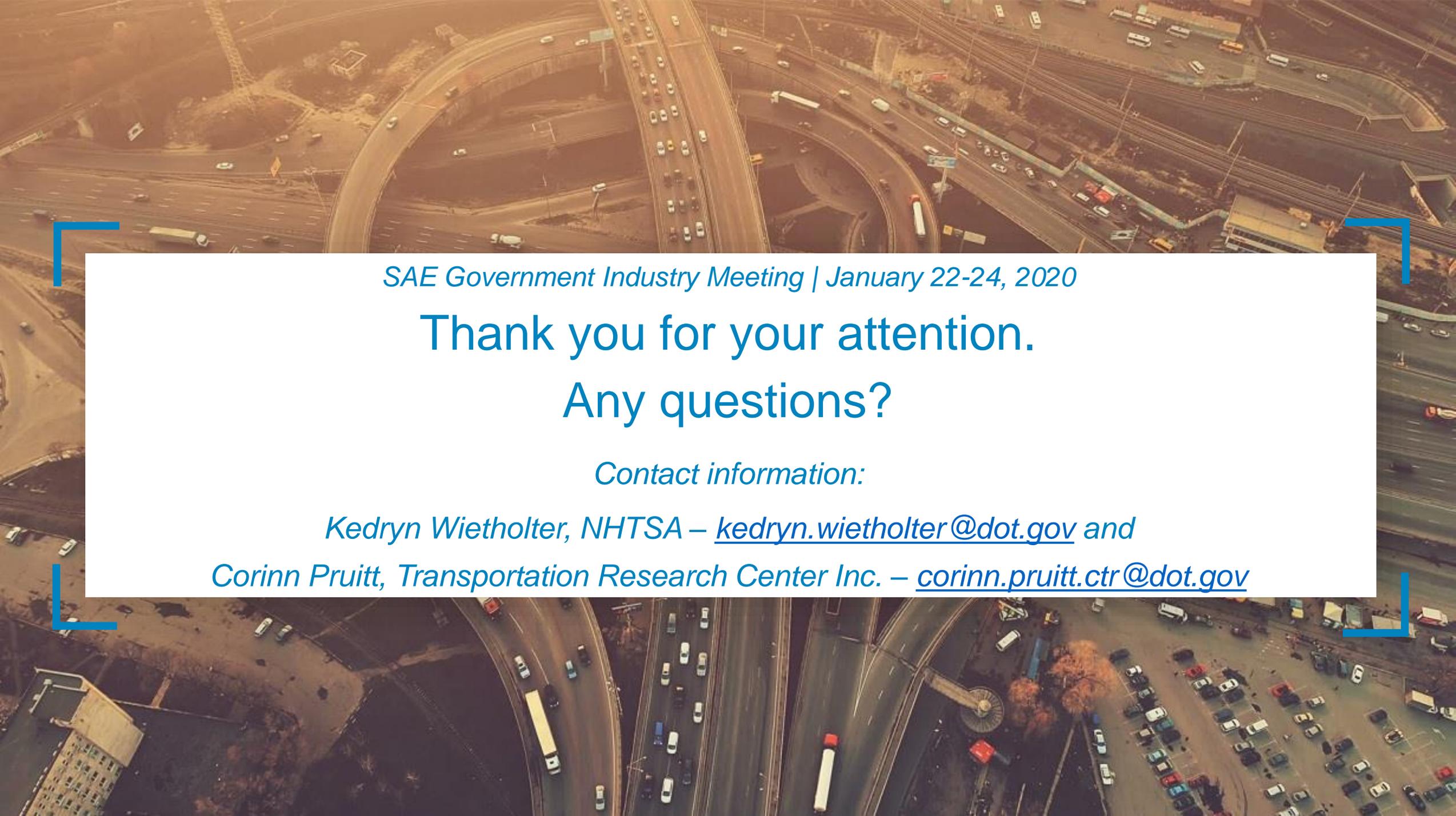
Status and Next Steps

Ongoing:

- FMVSS No. 209 assembly testing according to TP-209-08
- Tabulate and analyze assembly test results
 - Select a subset of belts for ECE R16 sled testing
- Fabrication and verification of ECE R16 bench and pulse/speed requirements
- Inspection and qualification of ECE R16 manikin

Next steps:

- Conduct ECE R16 sled tests
- Conduct rear seat sled tests
- Conduct FMVSS No. 209 assembly tensile tests at in use angles
- Report results and comparisons



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**Thank you for your attention.
Any questions?**

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