Crash Simulation of FMVSS No. 214 Safety Performance

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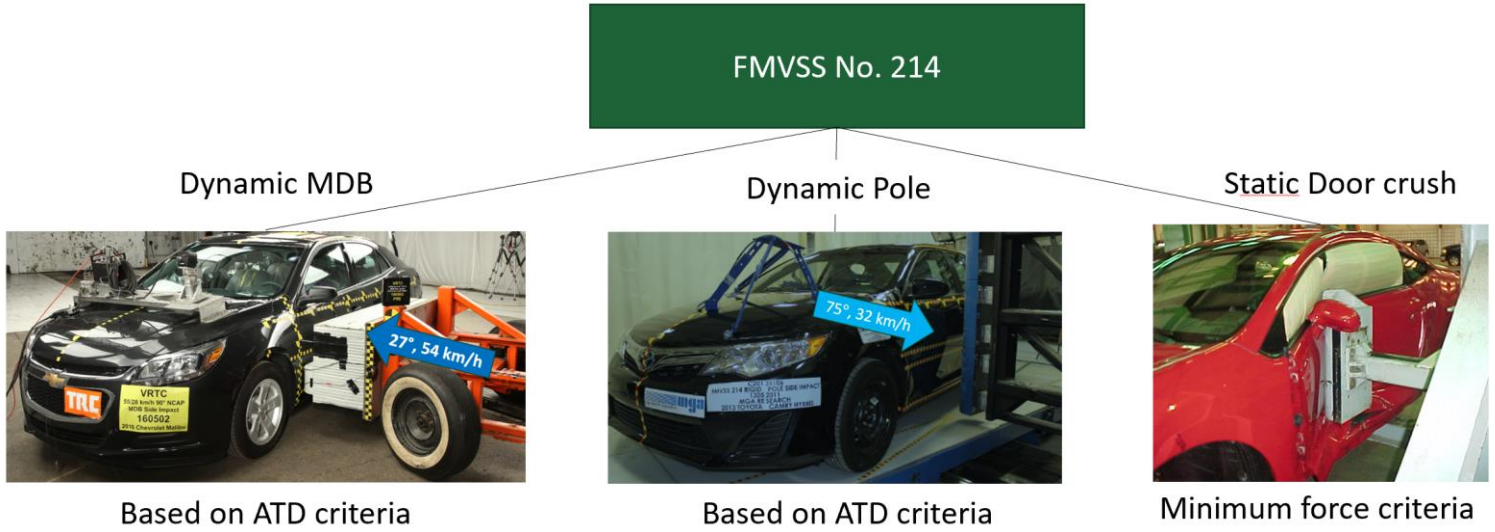
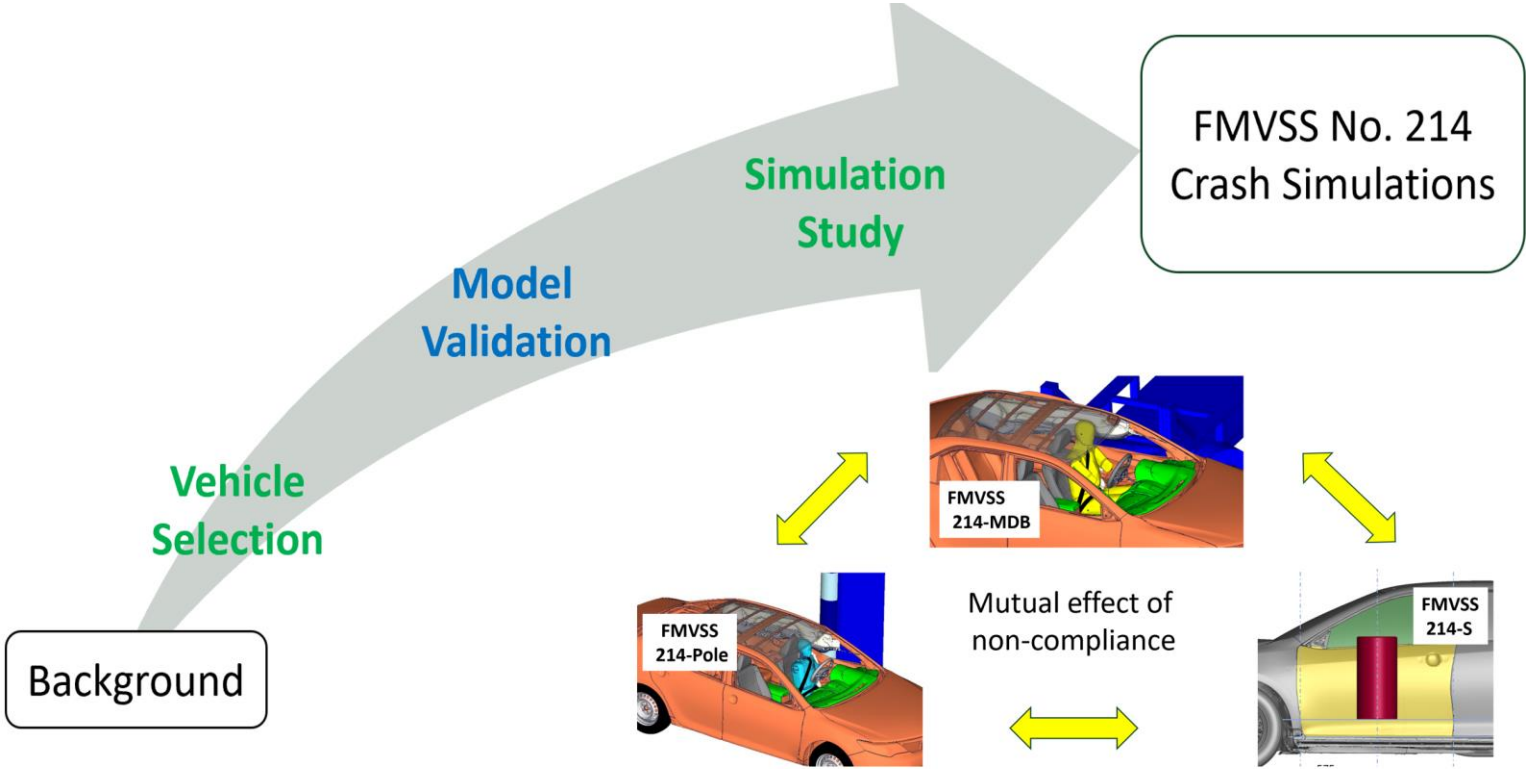
Motivation



1) How do design modifications that result in non-compliance for one of the configurations affect the other two load cases?

2) Is it feasible to use a dynamic performance measurement as a surrogate for the static test?

Approach


Background
Vehicle Selection
Model Validation
Simulation Study
FMVSS No. 214 Crash Simulations
FMVSS 214-MDB
FMVSS 214-Pole
Mutual effect of non-compliance
FMVSS 214-S

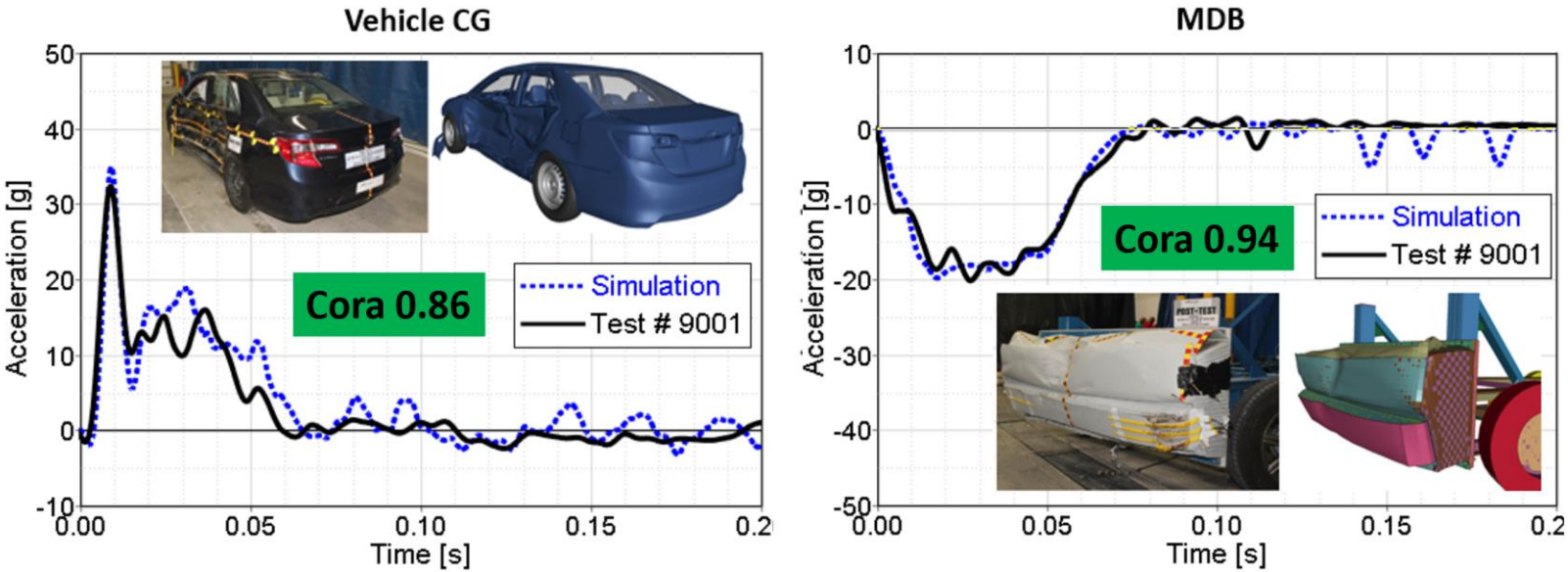
Vehicle Selection

Vehicle 1:
Toyota Camry Sedan
FE model exists

Vehicle 2:
Nissan Roque Crossover SUV
FE model is being developed

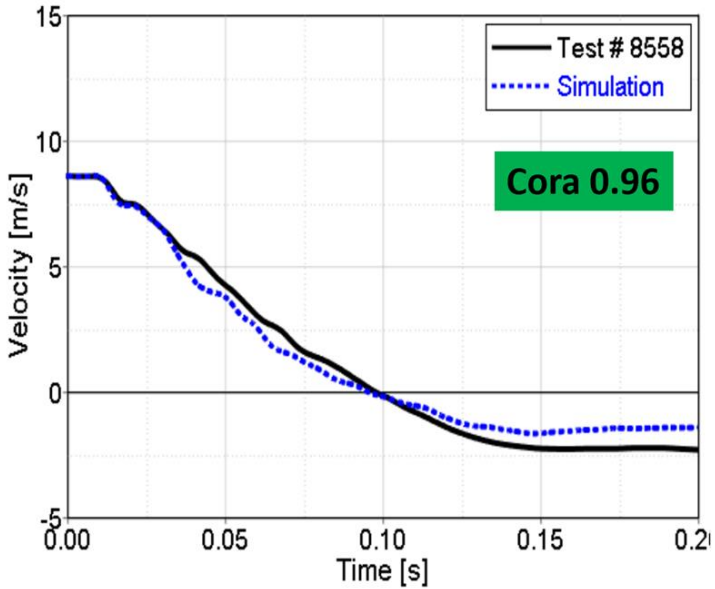
Sedan and SUV vehicles present different characteristics relevant for side impact, i.e. different mass, seating and sill height

Sedan Model Validation – FMVSS No. 214 - MDB



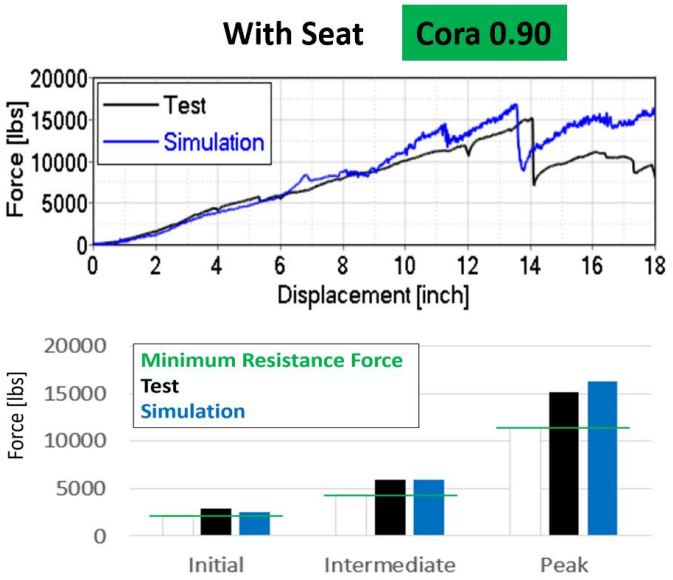
Test and simulation showed good correlation with respect to vehicle pulse, barrier and vehicle deformation

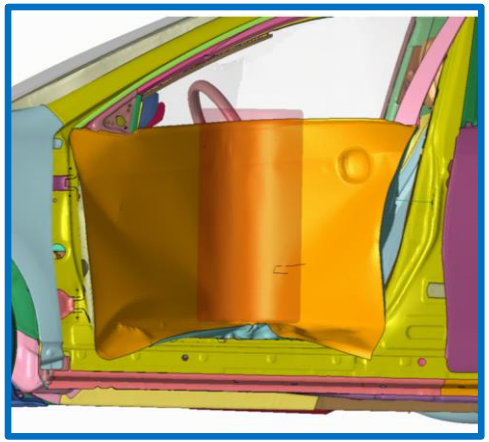
Sedan Model Validation – FMVSS No. 214 - Pole



Test and simulation showed excellent correlation with respect to vehicle pulse, and maximum exterior vehicle deformation

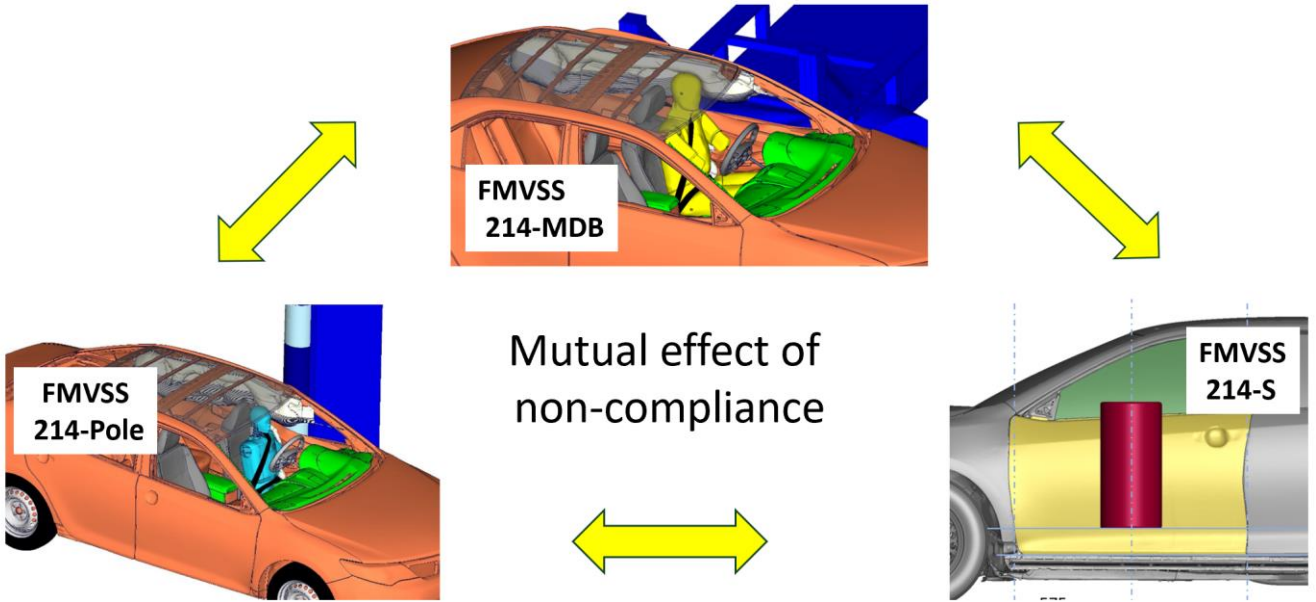
Sedan Model Validation – FMVSS No. 214 - Static





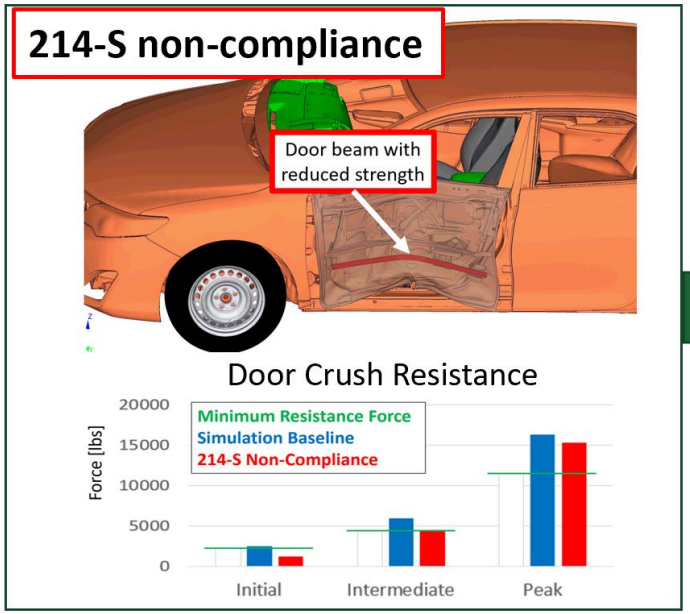
Test and simulation showed good correlation with respect to resistance force versus intrusion, initial, intermediate, and peak force values

Simulation Study - Mutual Effect of Non-compliance

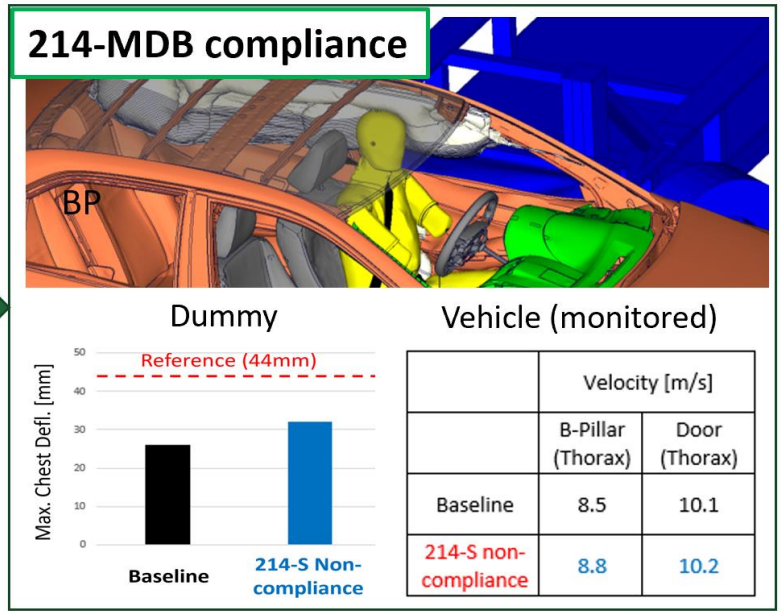


Different design modification were developed that resulted in non-compliance for each of the three configurations.

Simulation Study – Effect of FMVSS No. 214 - Static Non-compliance



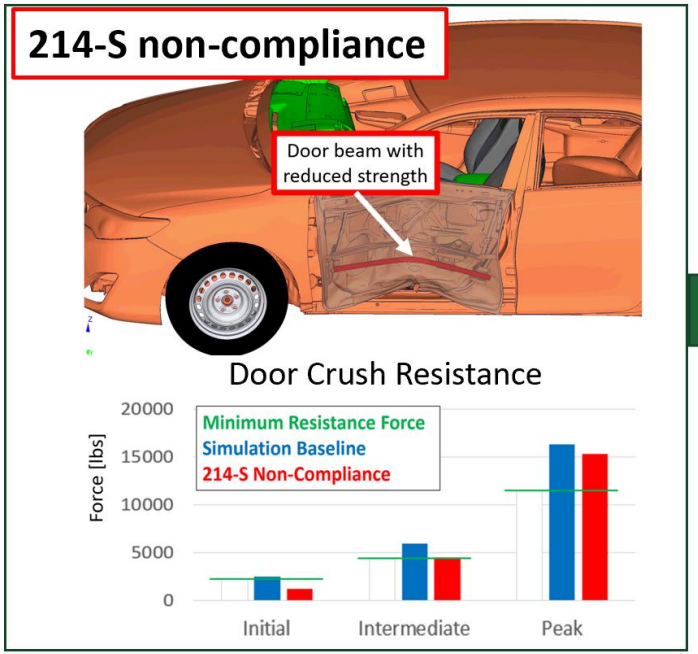
resulted in



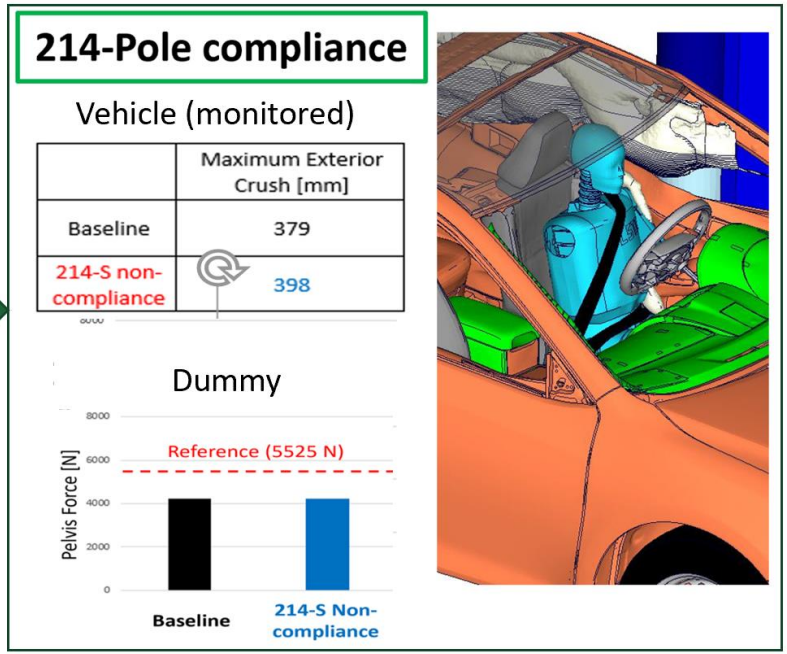
	Velocity [m/s]	
	B-Pillar (Thorax)	Door (Thorax)
Baseline	8.5	10.1
214-S non-compliance	8.8	10.2

Case Study indicated **FMVSS214-MDB compliance**
despite **FMVSS-214-static non-compliance**

Simulation Study – Effect of FMVSS No. 214 - Static Non-compliance



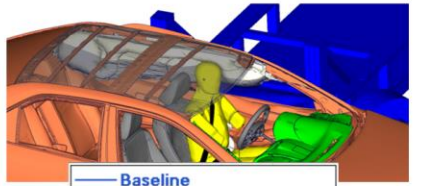
resulted in

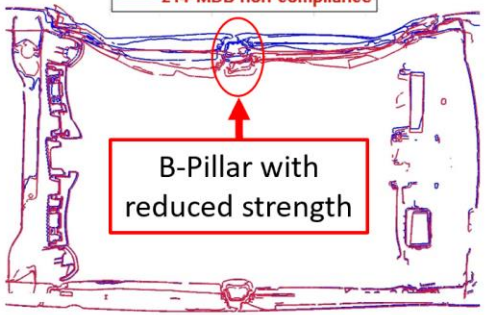


Case Study indicated **FMVSS214-Pole compliance**
despite **FMVSS-214-static non-compliance**

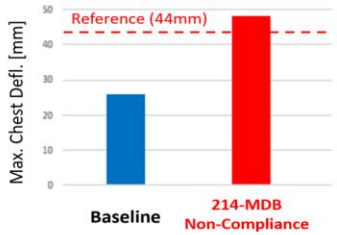
Simulation Study – Effect of FMVSS No. 214 - MDB Non-compliance

214-MDB non-compliance





Dummy

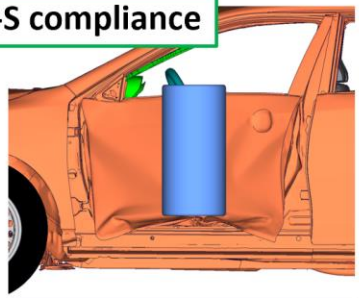


Vehicle (monitored)

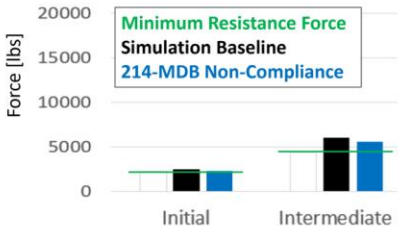
	Velocity [m/s]	
	B-Pillar	Door
Baseline	8.5	10.1
214-MDB non-compliance	10.8	11.7

resulted in

214-S compliance

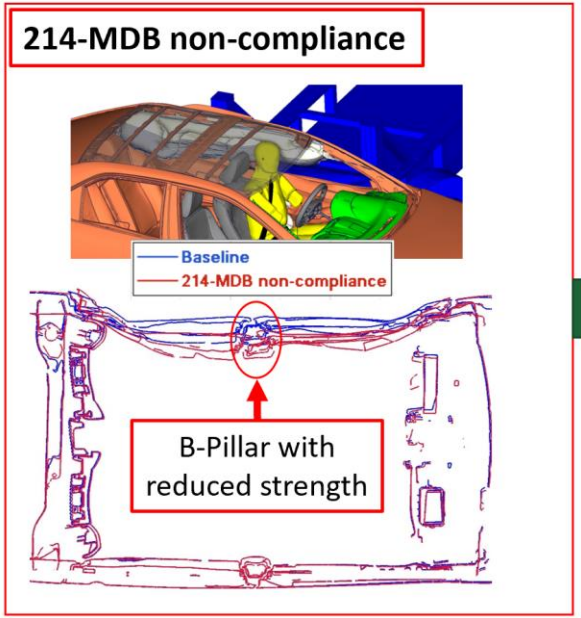


Door Crush Resistance

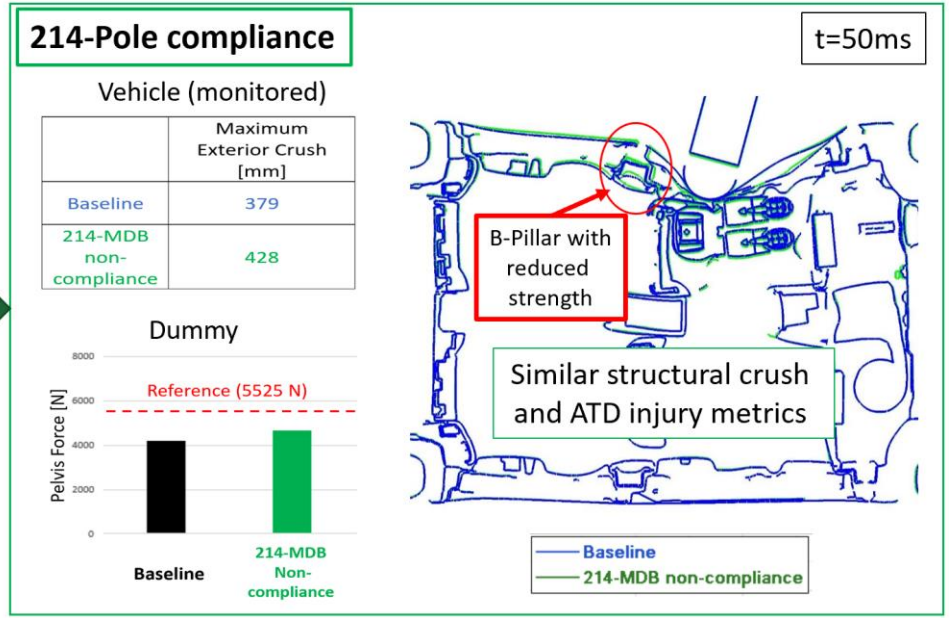


Case Study indicated **FMVSS No. 214-static compliance** despite **FMVSS No. 214 MDB non-compliance**

Simulation Study – Effect of FMVSS No. 214 - MDB Non-compliance

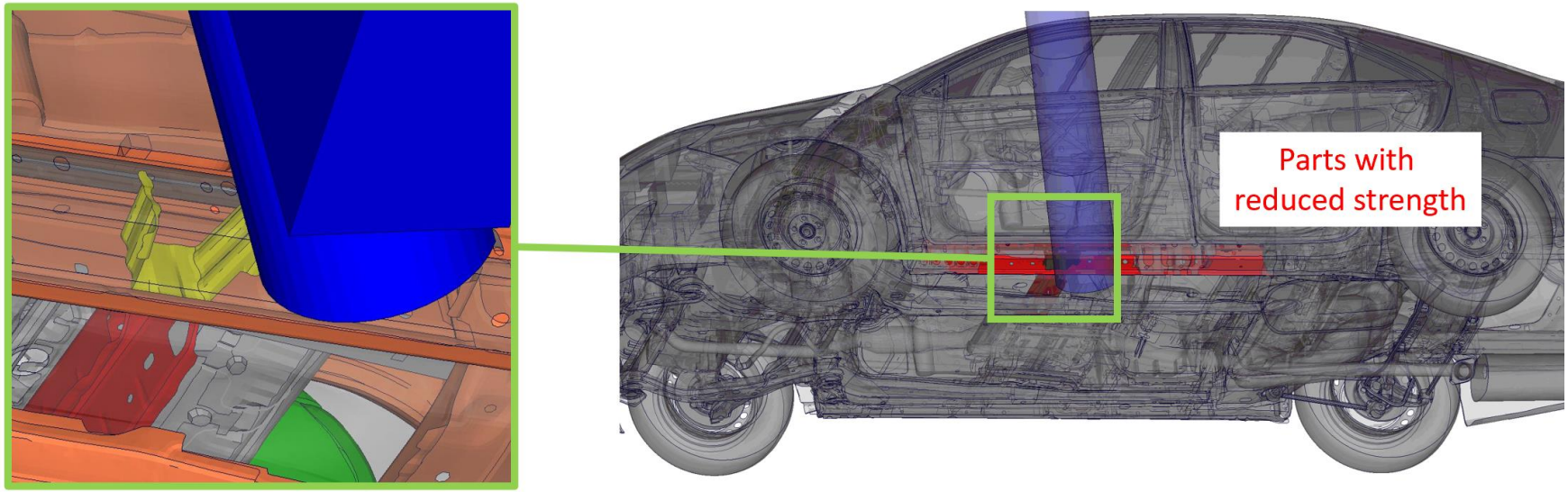


resulted in



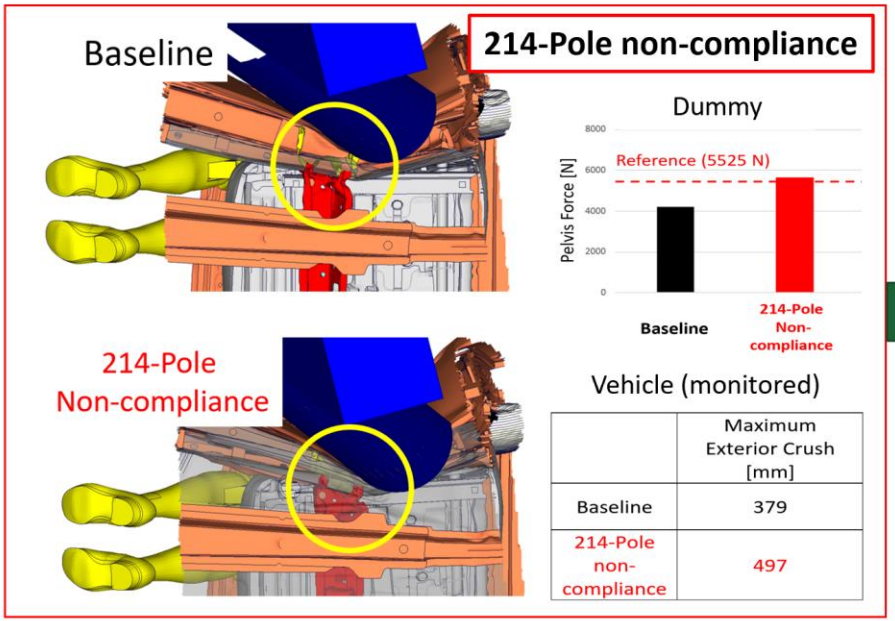
Case Study indicated **FMVSS No. 214-Pole compliance** despite **FMVSS No. 214 MDB non-compliance**

Simulation Study – FMVSS No. 214 – Pole – Design Modifications



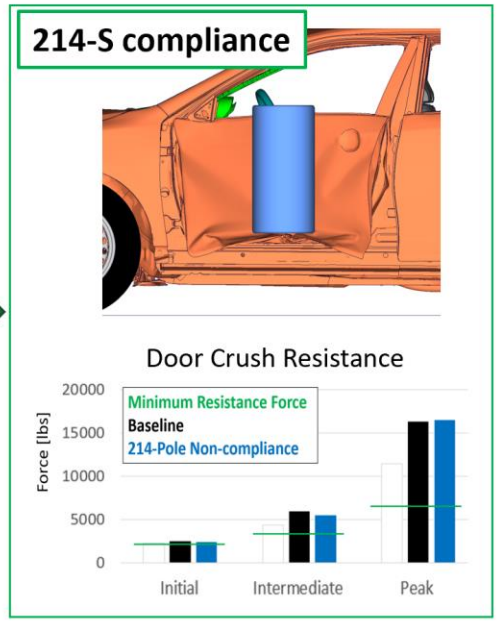
Sill, seat cross member, and reinforcement components were weakened to produce FVMSS No. 214-Pole non-compliance

Simulation Study – Effect of FMVSS No. 214 - Pole Non-compliance



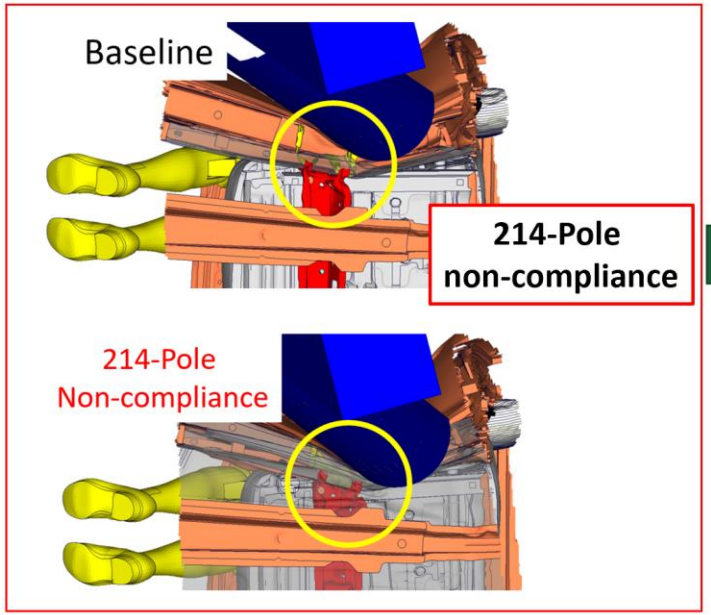
	Maximum Exterior Crush [mm]
Baseline	379
214-Pole non-compliance	497

resulted in



Case Study indicated **FMVSS No. 214-static compliance** despite **FMVSS No. 214 Pole non-compliance**

Simulation Study – Effect of FMVSS No. 214 - Pole Non-compliance



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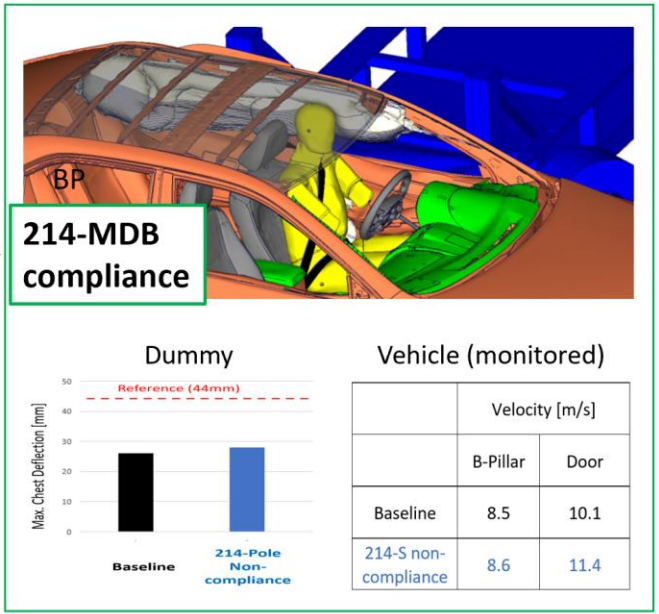
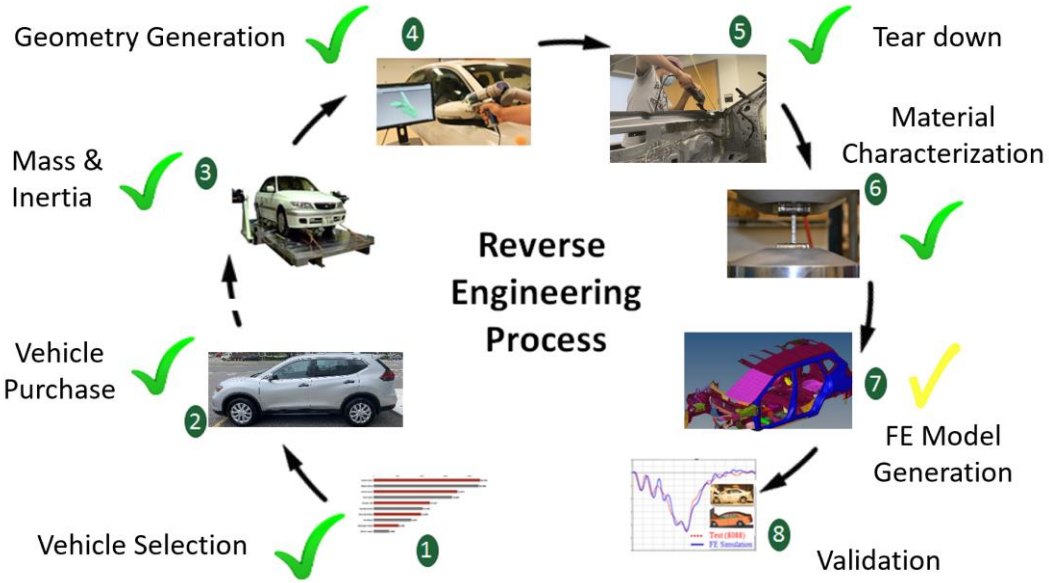


	Velocity [m/s]	
	B-Pillar	Door
Baseline	8.5	10.1
214-S non-compliance	8.6	11.4

Case Study indicated **FMVSS No. 214-MDB compliance** despite **FMVSS No. 214 Pole non-compliance**

Ongoing Work I – SUV Simulation Study

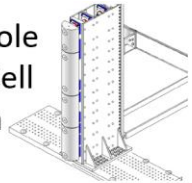


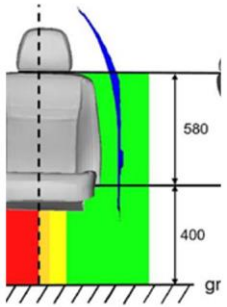
A FE model of a SUV Crossover vehicle is currently being developed to conduct similar simulation study

Ongoing Work II – Performance Criteria

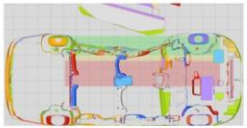
Force evaluation based on MDB deformation

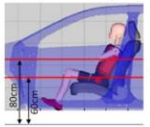
Rigid Pole Load Cell Data





Criteria similar to IIHS



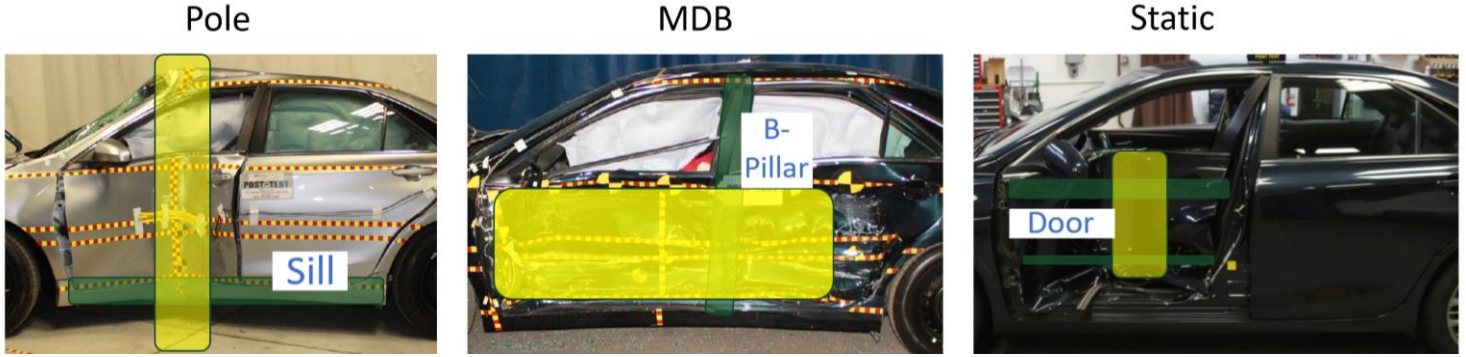


Can measurements from dynamic tests serve as a surrogate for the static test?

Exterior Crush

Can a performance criteria be defined that could eliminate the static door crush test by moving the door strength requirements into the dynamic side impact test(s)?

Preliminary FMVSS No. 214 Study Conclusions



- The three configurations engage different main load paths
- Structural modifications that resulted in non-compliance for one of the load cases did not result in non-compliance for the other two configurations
- There are limitations of using measurements from the dynamic test(s) to indicate door crush resistance as measured by the static test
- Feedback is welcome and can potentially be considered in the ongoing research

Acknowledgment

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Contact Info

Thank You

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