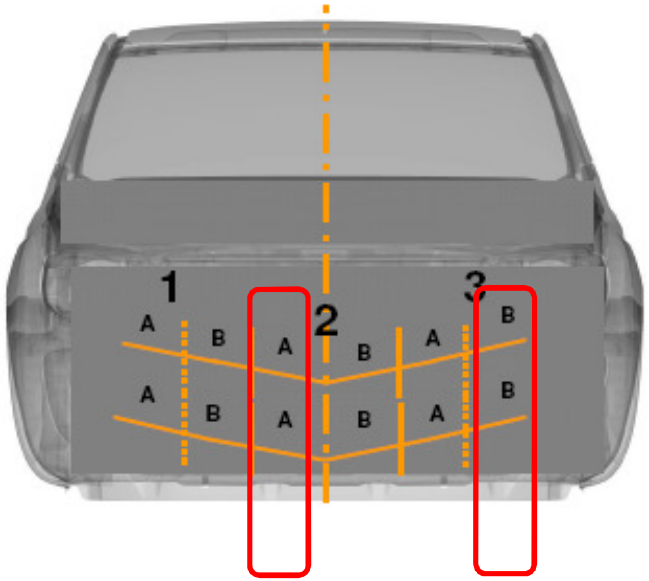
Ford
GTR09 US Vehicle Round Robin

March 19th, 2013

Ford Round Robin:

1. Test Set-up and Plan
2. Test Results
3. Impactor Issues
4. Summary

Ford - Test Set-up and Plan:



Vehicle Information:

- Mid-size truck/utility vehicle
- Bumper Lower Reference Line (BLRL) 350–485mm
- Bumper / fascia design similarly to sedan approach

Test Locations:

- Near middle (2A)
- Aligned with headlamps (3B)

Testing Objectives:

- Evaluation of repeatability and reproducibility to further understand the potential feasibility issues associated with mid-size truck/utility vehicles
  - ➢ Due to part availability and limited test time the objectives were adjusted to assess the influence of ride height

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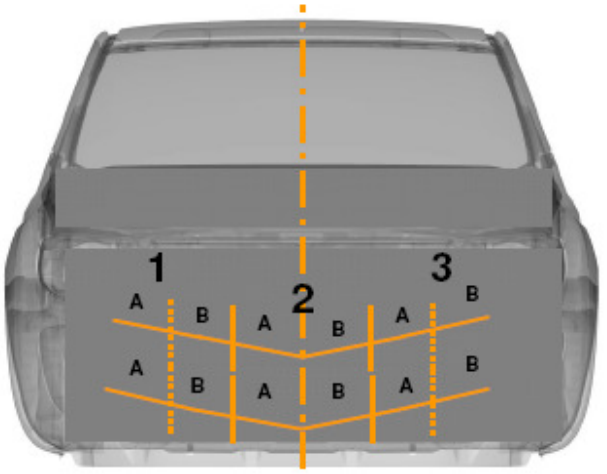
Ford - Test Results (Center Location):

Test Number	Location	Tibia 1 Nm	Tibia 2 Nm	Tibia 3 Nm	Tibia 4 Nm	ACL mm	MCL mm	PCL mm	Ride Height
GTR Proposed Criteria		340	340	340	340	13	22	13	
Test 1 (SN01)	2A	216	357	293	144	2.5	1.8	2.6	Low – 50 mm
Test 3 (SN01)	2B	325	370	272	100	5.9	7.1	2.4	Mid
Test 5 (SN01)	2B	339	297	187	72	10.5	19.7	6.1	High - 50 mm
Test 6 (E-leg)	2A	Data did not record							

Observations:

- MCL, PCL and ACL tend to increase with increasing ride height
- Tibia numbers did not show a trend



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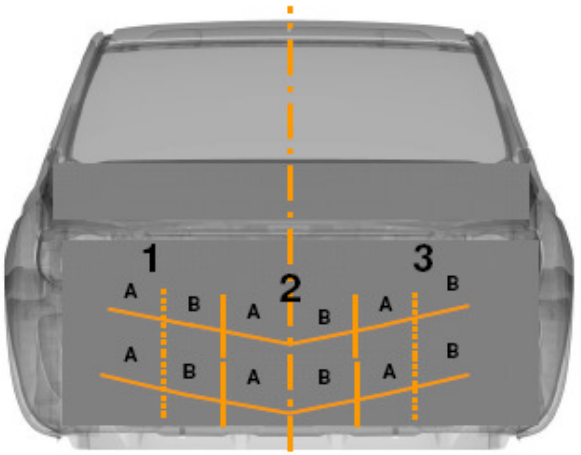
Ford - Test Results (Outside Location):

Test Number	Location	Tibia 1 Nm	Tibia 2 Nm	Tibia 3 Nm	Tibia 4 Nm	ACL mm	MCL mm	PCL mm	Ride Height
GTR Proposed Criteria		340	340	340	340	13	22	13	
Test 2 (SN01)	3B	153	138	112	63	4.4	7.8	2	Mid
Test 7 (E-leg)	3B	148	136	106	52	6.4	9.9	3	Mid
Test 4 (SN01)	1A	340	320	233	106	9.4	16.3	7.2	High - 50 mm

Observations:

- Similar to the center location, the measurements increased with increasing ride height
- Comparable results between SN01 (test 2) and E-Leg (test 5).



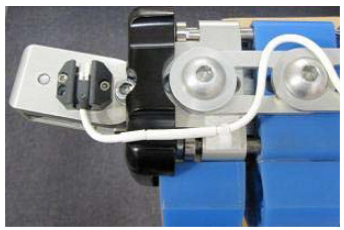
Ford - Flex Pli Impactor Issues:

SN01:

- Capacitor Issues: impactor was only recording approximately 500ms of data compared to the typically 2s.
  - DTS was called in to troubleshoot the leg and discovered that the capacitor failed. DTS replaced the capacitor.

E-Leg:

- Connection problems: the “Slice bus up to PC” connector disconnected from the circuit board inside the base slice.
  - The base slice was an older version. Inside the unit the wire was not strain relieved due to space. The wire tension caused the connector to separate. DTS was able to repair the base slice.
  - Connection issues continued, the capacitor was disconnected between runs in order for the software to recognize the leg
- The flesh cover zipper was broken and outer flesh cover was worn and had holes.
- The impactor was missing the quick release cable, cable housing and hanging bracket



Ford Testing - Summary

- Mid-size trucks and sport utility vehicles designed with off-road characteristics (larger approach angles and running clearances) will have increased challenges in meeting the proposed Flex-Pli criteria as compared to sedans.
  - Initial testing suggests sensitivity to ride height variations. This will increase the engineering complexity to use one design to account for the large range of ride height ranges.
- Full size trucks tend to have even larger bumper lower reference line ranges typically spanning 370 – 540mm. This large ride height range and other larger truck attributes, such as those list below, are not compatible with the GTR lower leg requirements regardless of impactor.
  - Overall vehicle length, maneuverability, garageabilty, rise to curb and ground clearance
  - Heavy duty bumper systems that support harsh worksite environments
  - Provisions for mounting snow plows and winches

Thank You!