Test Report

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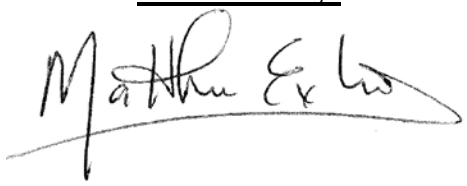
Report No.: 001-10A
Report Date: 1.07.10
Customer Ref.: P.O. #532097

New Flyer Industries Xcelsior, front and rear bumper installation certification.

Romeo RIM Inc. front bumper part number A20170001AXA and rear bumper part number A20180001AXA.

Performed By:



Matthew Exline
Development/Test Engineer

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Testing Summary

Vehicle Information
Vehicle Make: New Flyer Industries
Model: Xcelsior
Curb weight: 28.530 pounds as tested
Vehicle configuration: Actual bus was tested. Alternate configuration weight of 31,000 pounds was desired. Barrier impact speeds will be increased to simulate the alternate configuration weight.

Romeo RIM Inc. part numbers tested
Front: A20170001AXA SWEPT-BPR-FRT-101IN-NF-XCEL
Rear: A20180001AXA SWEPT-BPR-RR-100IN-NF-XCEL

New Flyer Industries part number cross reference
340289 Rev A Front
345569 Rev A Rear

Specifications for certification referenced:
APTA standard bus procurement guidelines dated July 1, 2001

Set up:
Front / Rear bumpers: The bumpers were mounted to the Xcelsior bus. Each test was performed in accordance with the APTA guidelines. To simulate the alternate configuration weight, the front impact speed was increased from 5.0 mph to 5.2 mph. The rear bumper impact speed was increased from 2.0 mph to 2.2 mph.

Objective

The objective of this project is to certify the application of the Romeo RIM Inc. HELP® bumper front and rear bumpers meet all prevailing APTA standard bus procurement guidelines dated July 1, 2001 as they relate to bumper impact performance. These guidelines are:

5.4.3.9 BUMPERS

5.4.3.9.2 Front Bumper

No part of the bus, including the bumper, shall be damaged as a result of a 5-mph impact of the bus at curb weight with a fixed, flat barrier perpendicular to the bus' longitudinal centerline. The bumper shall return to its pre-impact shape within 10 minutes of the impact. The bumper shall protect the bus from damage as a result of 6.5 mph impacts at any point by the Common Carriage with Contoured Impact Surface defined in Figure 2 of FMVSS 301 loaded to 4,000 pounds parallel to the longitudinal centerline of the bus and 5.5-mph impacts into the corners at a 30° angle to the longitudinal centerline of the bus. The energy absorption system of the bumper shall be independent of every power system of the bus and shall not require service or maintenance in normal operation during the service life of the bus. The bumper may increase the overall bus length specified in Section 5.1.5.1.1 by no more than 7 inches.

5.4.3.9.3 Rear Bumper

No part of the bus, including the bumper, shall be damaged as a result of a 2-mph impact with a fixed, flat barrier perpendicular to the longitudinal centerline of the bus. The bumper shall return to its pre-impact shape within 10 minutes of the impact. When using a yard tug with a smooth, flat plate bumper 2 feet wide contacting the horizontal centerline of the rear bumper, the bumper shall provide protection at speeds up to 5 mph, over pavement discontinuities up to 1 inch high, and at accelerations up to 2 mph/sec. The rear bumper shall protect the bus, when impacted anywhere along its width by the Common Carriage with Contoured Impact Surface defined in Figure 2 of FMVSS 301 loaded to 4,000 pounds, at 4 mph parallel to, or up to a 30° angle to, the longitudinal centerline of the bus. The rear bumper shall be shaped to preclude unauthorized riders standing on the bumper. The bumper shall be independent of all power systems of the bus and shall not require service or maintenance in normal operation during the service life of the bus. The bumper may increase the overall bus length specified in Section 5.1.5.1.1 by no more than 7 inches.

5.4.3.9.4 Bumper Material

Bumper material shall be corrosion-resistant and withstand repeated impacts of the specified loads without sustaining damage. Visible surfaces shall be black or color -coordinated with the bus exterior. These bumper qualities shall be sustained throughout the service life of the bus.

Test procedures

A. Barrier Impact
The vehicle is instrumented with equipment to measure and record speed, deceleration ("G") and total system deflection. Impact load forces will be measured through eight, 100,000lb. Force load cells mounted to the impact barrier. The test vehicle is driven into the fixed flat barrier such as to contact the full energy absorbing face of the bumper.

B. Center Impact
The vehicle is instrumented with equipment to measure and record deflection. The impact sled is instrumented to measure and record deceleration and impact load. An impact sled with in impact face as described in FMVSS 301 is aligned to impact the center of the bumper perpendicular to the longitudinal centerline of the vehicle.

C. Corner Impact
The vehicle is instrumented with equipment to measure and record deflection. The impact sled is instrumented to measure and record deceleration and impact load. An impact sled with in impact face as described in FMVSS 301 is aligned to impact the extreme outboard corner of the bumper 30° from the longitudinal centerline of the vehicle.

D. Vehicle preparation
The vehicle was loaded at curb weight with a full fuel load of 125 gallons of diesel fuel.

Test Instrumentation

Velocity

1. Barrier impact speed is measured with a digital 5th wheel mounted to the test vehicle and incorporates a digital display of the speed. Center and corner impact velocity is measured with a digital "speed trap" sensor and converted to MPH via a simple calculation.

Stroke (system deflection)

1. Stroke is measured with an electronic LVDT mounted to the vehicle or test sled.

Force (Load)

1. Barrier impact load forces are measured with eight 100,000lb load cells mounted behind the impact barrier
2. Center and 30° corner impact test forces are measured with a +/- 50 "g" accelerometer mounted to the impact plane and converted to force.

Deceleration (g)

1. Barrier impact deceleration is measured with a +/- 50 "g" accelerometer mounted to the simulator sled
2. Center and 30° corner impact deceleration is measured with a +/- 50 "g" accelerometer mounted to the face of the FMVSS 301 test sled

Tests data sheets– Following are the data plots from each impact event

5.4.3.9.2 Front Bumper

Front bumper barrier impact – Impact speed of 5.2mph

4.4”	94670 lbs.	3.0	5.2 mph
Max. Stroke	Peak Load	Peak “G”	Impact speed

Post test observations:
Two cracks propagated from existing stone chips. One on each side of the front windshield. No visible body damage.
Functionality checks:
Front access door operational
Front and rear entrance doors operational
Drivers side window operational

Front bumper center impact #1 – Impact speed of 6.5 mph

4.4”	18979 lbs.	7.1	6.5 mph
Max. Stroke	Peak Load	Peak “G”	Impact speed

Front bumper center impact #2 – Impact speed of 6.4 mph

4.5”	18447 lbs.	7.2	6.4 mph
Max. Stroke	Peak Load	Peak “G”	Impact speed

Post test observations:
No visible body damage.
Functionality checks:
Front access door operational
Front and rear entrance doors operational
Drivers side window operational

Front bumper corner impact #1 – Impact speed of 5.4

5.9”	12991 lbs.	7.3	5.4 mph
Max. Stroke	Peak Load	Peak “G”	Impact speed

Front bumper corner impact #2 – Impact speed of 5.6

6.0”	18240 lbs.	6.8	5.6 mph
Max. Stroke	Peak Load	Peak “G”	Impact speed

Post test observations:
No visible body damage.
Functionality checks:
Front access door operational
Front and rear entrance doors operational
Drivers side window operational

5.4.3.9.3 Rear Bumper

Rear bumper barrier impact – Impact speed of 2.5mph

1.9”	73161 lbs.	2.5	2.5 mph
Max. Stroke	Peak Load	Peak “G”	Impact speed

Post test observations:
No visible body damage.
Functionality checks:
Rear engine access door operational
Upper rear access door operational
Front and rear entrance doors operational

Rear bumper center impact #1 – Impact speed of 4.0mph

2.6”	11710 lbs.	4.5	4.0 mph
Max. Stroke	Peak Load	Peak “G”	Impact speed

Post test observations:
No visible body damage.
Functionality checks:
Rear engine access door operational
Upper rear access door operational
Front and rear entrance doors operational

Rear bumper center impact #2 – Impact speed of 4.2mph

2.9”	15281 lbs.	5.4	4.2 mph
Max. Stroke	Peak Load	Peak “G”	Impact speed

Post test observations:
No visible body damage.
Functionality checks:
Rear engine access door operational
Upper rear access door operational
Front and rear entrance doors operational

Rear bumper corner impact #1 – Impact speed of 4.0mph

3.8”	10776 lbs.	4.1	4.0 mph
Max. Stroke	**Peak Load**	**Peak “G”**	**Impact speed**

Post test observations:
No visible body damage.
Functionality checks:
Rear engine access door operational
Upper rear access door operational
Front and rear entrance doors operational

Rear bumper corner impact #2 – Impact speed of 4.2mph

3.8”	12743 lbs.	5.1	4.2 mph
Max. Stroke	**Peak Load**	**Peak “G”**	**Impact speed**

Post test observations:
No visible body damage.
Functionality checks:
Rear engine access door operational
Upper rear access door operational
Front and rear entrance doors operational

5.4.3.9.4 Bumper Material

Requirements of this portion of the specification were met. The bumper substrate material is a black, polyurethane material. This material is not affected by salts, diesel fuel, oils or any other common used materials expected to be seen in use. The material is black in color and is additionally top coated with a flexible black paint for long life.

Romeo RIM Inc. - Test Report Form

Report file number	001-10A	**Date of test**	12.16.09
Customer	New Flyer Industries	**Data**	
Test type	Front bumper barrier impact	**Impact speed**	5.2 mph
Vehicle weight (as tested)	28,350 lbs.	**Load**	94670 lbs.
Component description	SWEPT-BPR-FRT-101IN-NF-XCEL	**System deflection**	4.5"
Customer part number	340289 Rev. A	**Deceleration**	3.0 "g"
RRI part number	A20170001AXA	Internal data file #	
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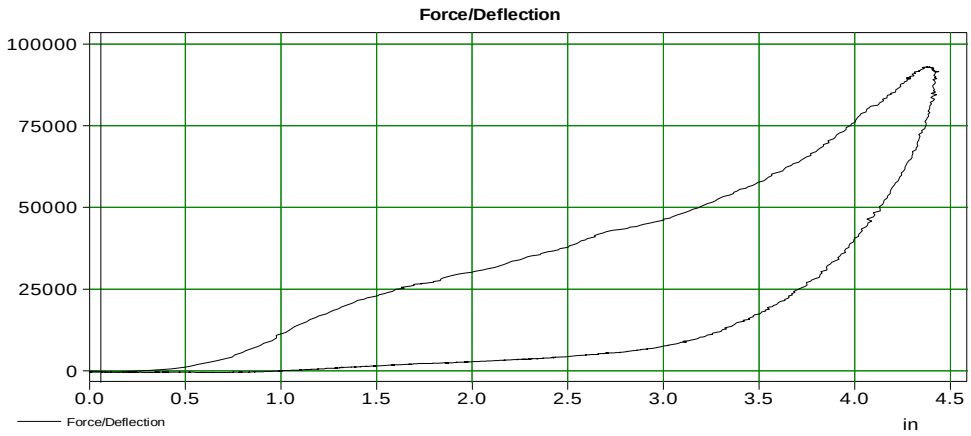

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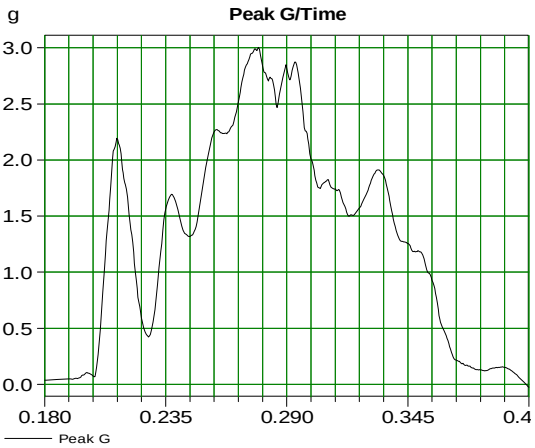

Graph #2

Notes:

Impact speed was adjusted to 5.2 mph to accommodate for alternate configuration weight of 31,000 pound curb weight
Two cracks in the windshield were noted which were caused by pre-existing stone chip propogation

Notes/Pic's

Romeo RIM Inc. - Test Report Form

Report file number	001-10A	**Date of test**	12.17.09
Customer	New Flyer Industries	**Data**	
Test type	Front bumper center impact #1	**Impact speed**	6.5 mph
Vehicle weight (as tested)	28,350 lbs.	**Load**	18979 lbs.
Component description	SWEPT-BPR-FRT-101IN-NF-XCEL	**System deflection**	4.3"
Customer part number	340289 Rev. A	**Deceleration**	7.0 "g"
RRI part number	A20170001AXA	Internal data file #	
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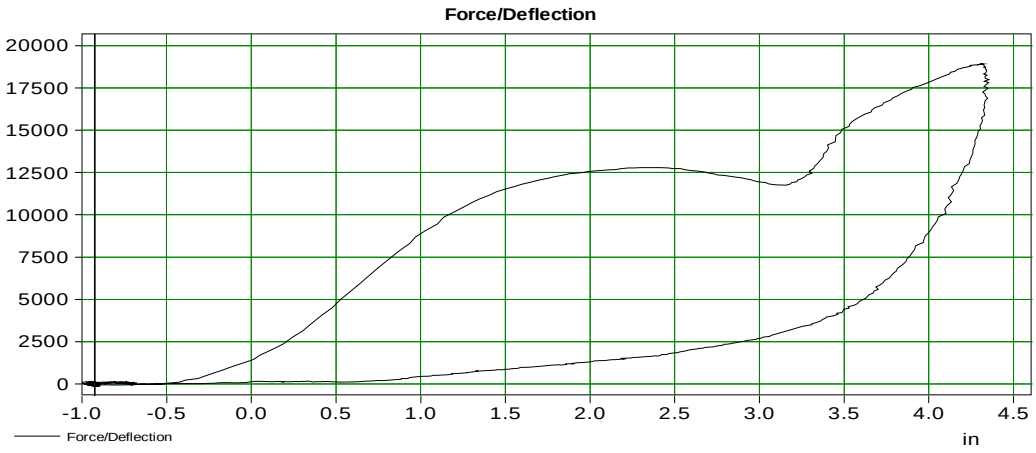

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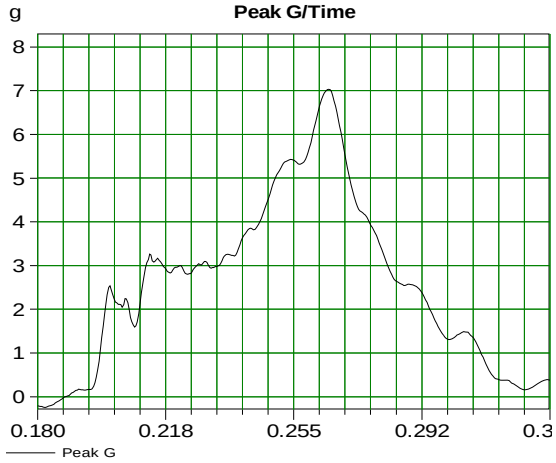

Graph #2

Notes:

Notes/Pic's

Romeo RIM Inc. - Test Report Form

Report file number	001-10A	**Date of test**	12.17.09
Customer	New Flyer Industries	**Data**	
Test type	Front bumper center impact #2	**Impact speed**	6.4 mph
Vehicle weight (as tested)	28,350 lbs.	**Load**	18172 lbs.
Component description	SWEPT-BPR-FRT-101IN-NF-XCEL	**System deflection**	4.5"
Customer part number	340289 Rev. A	**Deceleration**	7.1 "g"
RRI part number	A20170001AXA	Internal data file #	
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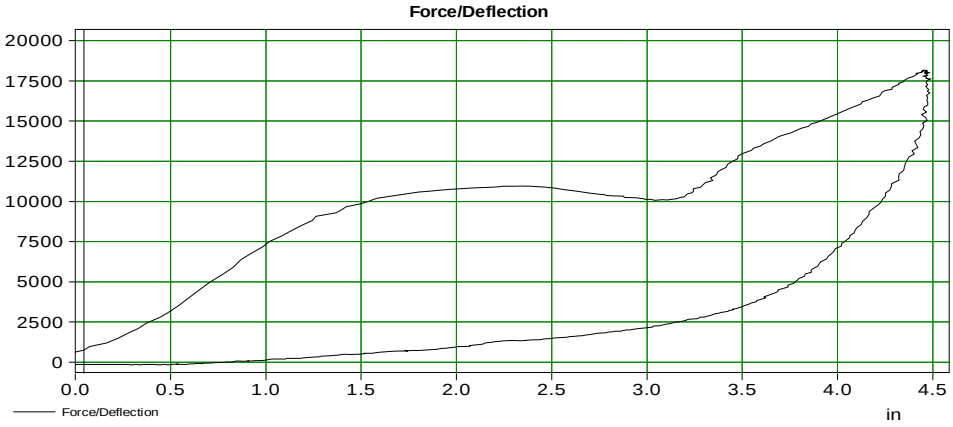

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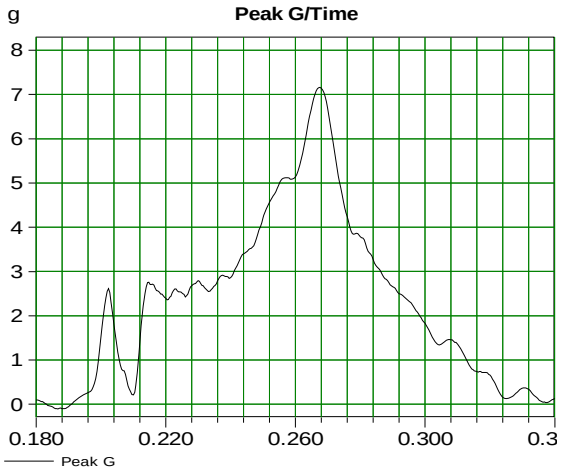

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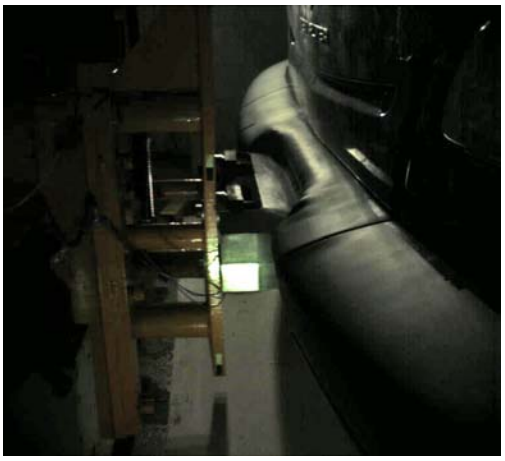

Notes/Pic's

Romeo RIM Inc. - Test Report Form

Report file number	001-10A	**Date of test**	12.17.09
Customer	New Flyer Industries	**Data**	
Test type	Front bumper corner impact #1	**Impact speed**	5.4 mph
Vehicle weight (as tested)	28,350 lbs.	**Load**	12991 lbs.
Component description	SWEPT-BPR-FRT-101IN-NF-XCEL	**System deflection**	5.9"
Customer part number	340289 Rev. A	**Deceleration**	7.3 "g"
RRI part number	A20170001AXA	Internal data file #	
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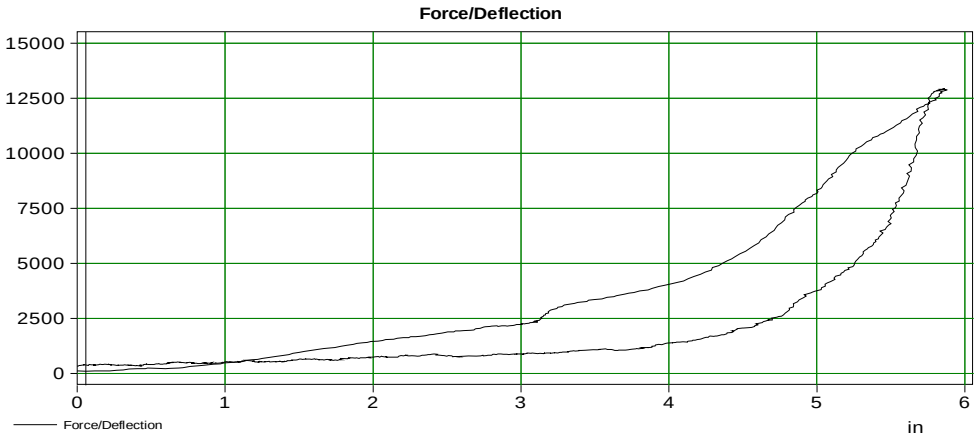

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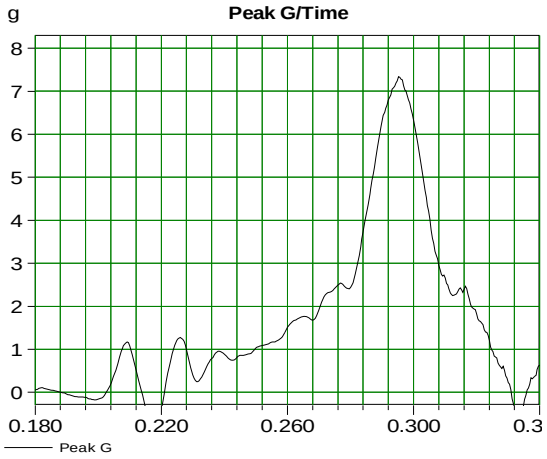

Graph #2

Notes:

Notes/Pic's

Romeo RIM Inc. - Test Report Form

Report file number	001-10A	**Date of test**	12.17.09
Customer	New Flyer Industries	**Data**	
Test type	Front bumper corner impact #2	**Impact speed**	5.6 mph
Vehicle weight (as tested)	28,350 lbs.	**Load**	18240 lbs.
Component description	SWEPT-BPR-FRT-101IN-NF-XCEL	**System deflection**	6.0"
Customer part number	340289 Rev. A	**Deceleration**	6.8 "g"
RRI part number	A20170001AXA	Internal data file #	
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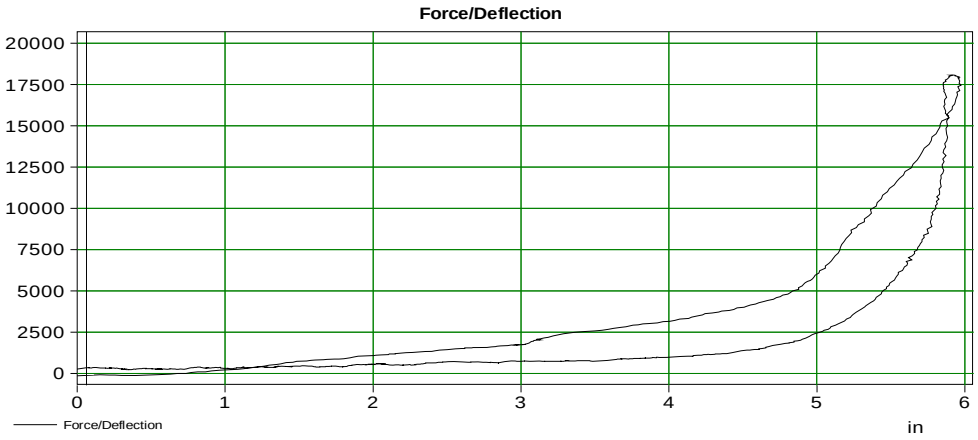

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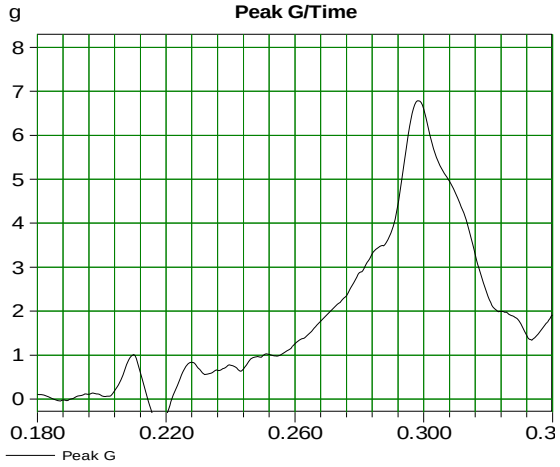

Graph #2

Notes:

Notes/Pic's

Romeo RIM Inc. - Test Report Form

Report file number	001-10A	**Date of test**	12.18.09
Customer	New Flyer Industries	**Data**	
Test type	Rear bumper barrier impact	**Impact speed**	2.5 mph
Vehicle weight (as tested)	28,350 lbs.	**Load**	73161 lbs.
Component description	SWEPT-BPR-RR-101IN-NF-XCEL	**System deflection**	1.9"
Customer part number	345569 Rev. A	**Deceleration**	2.4 "g"
RRI part number	A20180001AXA	Internal data file #	
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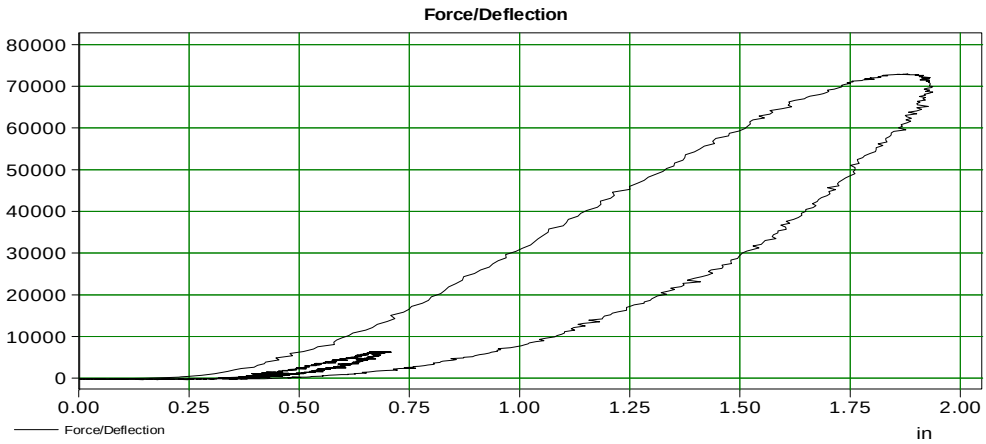

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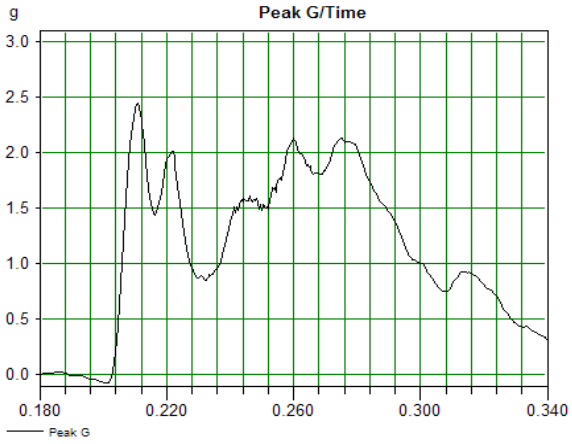

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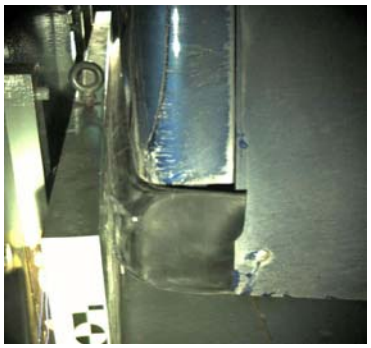

Impact speed was adjusted to 2.5 mph to accommodate for alternate configuration weight of 31,000 pound curb weight

Notes/Pic's

Romeo RIM Inc. - Test Report Form

Report file number	001-10A	**Date of test**	12.17.09
Customer	New Flyer Industries	**Data**	
Test type	Rear bumper center impact #1	**Impact speed**	4.0 mph
Vehicle weight (as tested)	28,350 lbs.	**Load**	11710 lbs.
Component description	SWEPT-BPR-RR-101IN-NF-XCEL	**System deflection**	2.6"
Customer part number	345569 Rev. A	**Deceleration**	4.5 "g"
RRI part number	A20180001AXA	Internal data file #	
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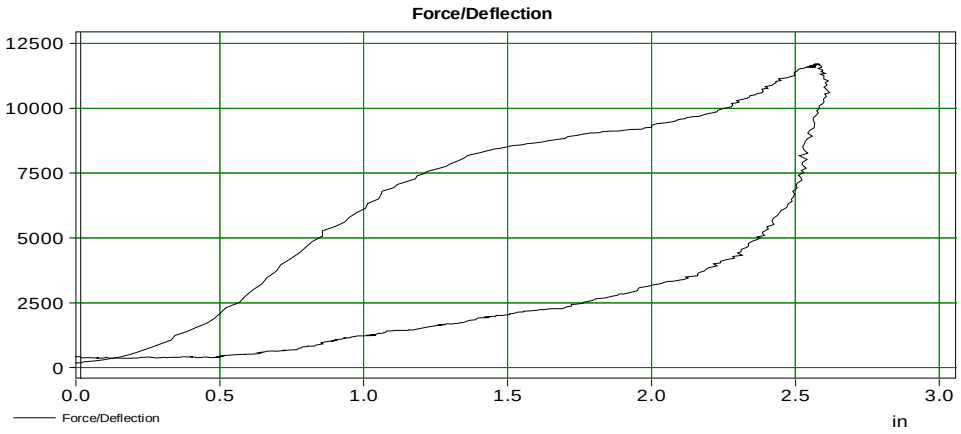

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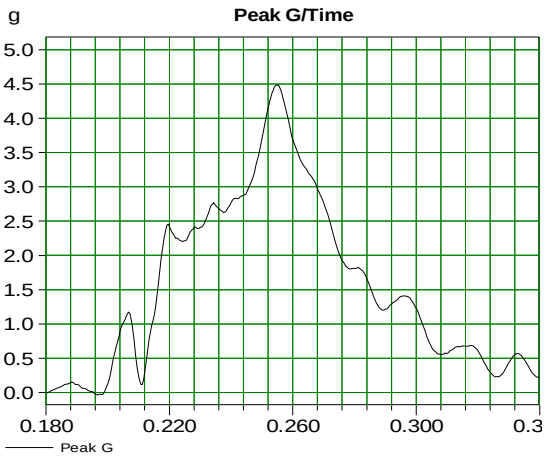

Graph #2

Notes:

Notes/Pic's

Romeo RIM Inc. - Test Report Form

Report file number	001-10A	**Date of test**	12.17.09
Customer	New Flyer Industries	**Data**	
Test type	Rear bumper center impact #2	**Impact speed**	4.2 mph
Vehicle weight (as tested)	28,350 lbs.	**Load**	15281 lbs.
Component description	SWEPT-BPR-RR-101IN-NF-XCEL	**System deflection**	2.9"
Customer part number	345569 Rev. A	**Deceleration**	5.4 "g"
RRI part number	A20180001AXA	Internal data file #	
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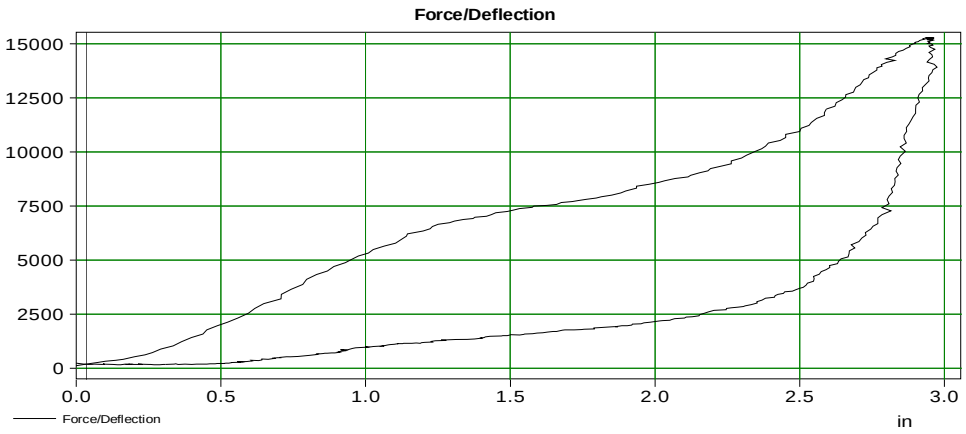

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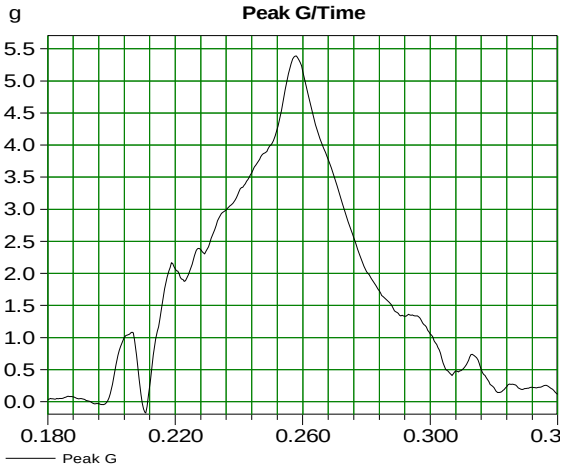

Graph #2

Notes:

Notes/Pic's

Romeo RIM Inc. - Test Report Form

Report file number	001-10A	**Date of test**	12.17.09
Customer	New Flyer Industries	**Data**	
Test type	Rear bumper corner impact 1	**Impact speed**	4.0 mph
Vehicle weight (as tested)	28,350 lbs.	**Load**	10776 lbs.
Component description	SWEPT-BPR-RR-101IN-NF-XCEL	**System deflection**	3.8"
Customer part number	345569 Rev. A	**Deceleration**	4.1 "g"
RRI part number	A20180001AXA	Internal data file #	
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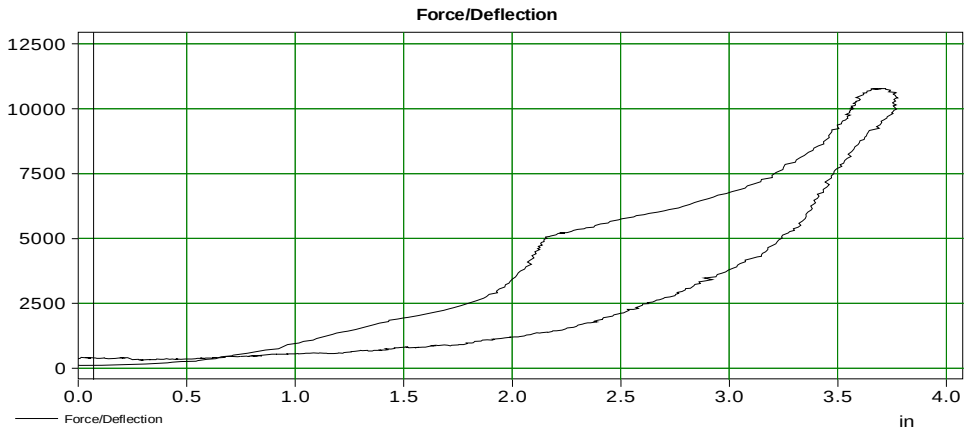

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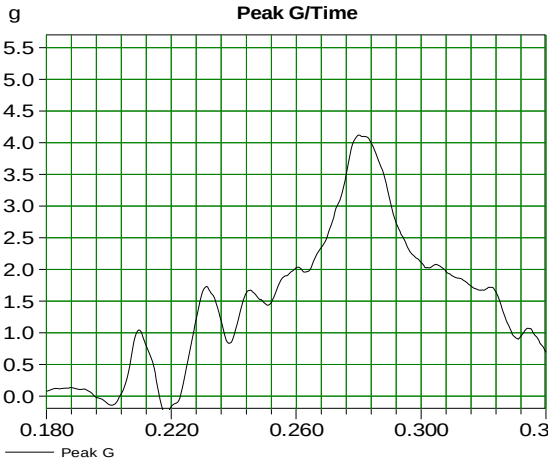

Graph #2

Notes:

Notes/Pic's

Romeo RIM Inc. - Test Report Form

Report file number	001-10A	**Date of test**	12.18.09
Customer	New Flyer Industries	**Data**	
Test type	Rear bumper corner impact 2	**Impact speed**	4.2 mph
Vehicle weight (as tested)	28,350 lbs.	**Load**	12743 lbs.
Component description	SWEPT-BPR-RR-101IN-NF-XCEL	**System deflection**	3.8"
Customer part number	345569 Rev. A	**Deceleration**	5.1 "g"
RRI part number	A20180001AXA	Internal data file #	
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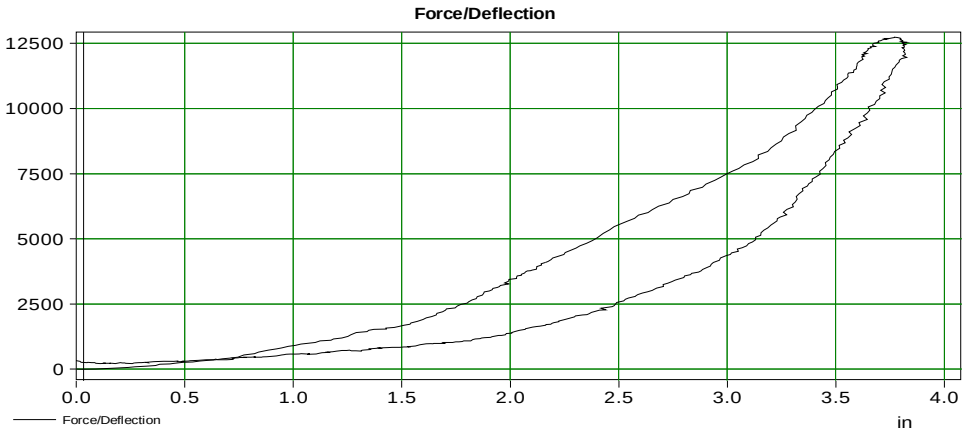

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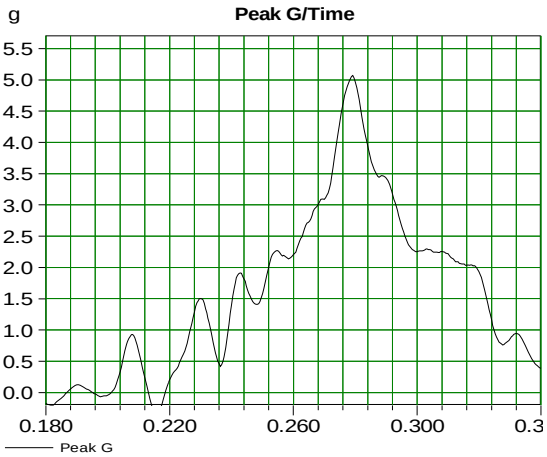

Graph #2

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Notes/Pic's